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TWENTY-SIXTH ANNUAL REPORT

OF THE

ENTOMOLOGICAL SOCIETY

OF

ONTARIO

1895.

PUBLISHED BY THE ONTARIO DEPARTMENT OF AGRICULTURE, TORONTO.

PRINTED BY ORDER OF THE LEGISLATIVE ASSEMBLY.

TORONTO:
WARWICK BROS. & RUTTER, PRINTERS &C., 68 AND 70 FRONT STREET WEST.
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PROF. C. V. RILEY, M.A., Ph. D.

WILLIAM H. EDWARDS,
HONORARY MEMBER OF THE ENTOMOLOGICAL SOCIETY OF ONTARIO, ETC.

TWENTY-SIXTH ANNUAL REPORT

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ENTOMOLOGICAL SOCIETY OF ONTARIO,

1895.

To the Honorable the Minister of Agriculture :

SIR,—In accordance with the provisions of our Act of Incorporation, I beg to submit herewith the Twenty-Sixth Annual Report of the Entomological Society of Ontario.

The report contains an account of the proceedings at our annual meeting, which was held in the city of London on the 27th and 28th of November last, for the election of officers and the transaction of the general business of the Society. A full report is given of the addresses delivered and papers read during the sessions, as well as the financial statement of the Treasurer and the reports of the sections and other departments of the Society.

The Canadian Entomologist, the monthly magazine issued by the Society, has been regularly published and has now completed its twenty-seventh volume, which in value and interest fully maintains the high reputation which it has so long held.

I have the honor to be, Sir,

Your obedient servant,

W. E. SAUNDERS,

Secretary.

OFFICERS FOR 1896.

President	J. W. Dearness	London.
Vice-President	H. H. Lyman	Montreal.
Secretary	W. E. Saunders	do
Treasurer	J. A. Balkwill	do
Directors :		
Division No. 1	James Fletcher	Ottawa.
" 2	Rev. C. J. S. Bethune	Port Hope.
" 3	Gamble Geddes	Toronto.
" 4	A. H. Kilman	Ridgeway.
" 5	R. W. Rennie	London.
Librarian and Curator	J. A. Moffat	do
Auditors	J. H. Bowman	do
	J. M. Denton	do
Editor of the "Canadian Entomologist"	Rev. C. J. S. Bethune	Port Hope.
Editing Committee	J. Fletcher	Ottawa.
	H. H. Lyman	Montreal.
	Rev. T. W. Fyles	S. Quebec.
	J. M. Denton	London.
Delegate to the Royal Society	J. D. Evans	Trenton.
Committee on Field Days	Dr. Woolverton, Messrs. Sherwood, McClement, Balkwill, Saunders, Anderson, Rennie, Bowman, Elliott, and Stevenson	London.

ANNUAL MEETING OF THE ENTOMOLOGICAL SOCIETY

1895

The thirty-third annual meeting of the Entomological Society of Ontario was held in its rooms in Victoria Hall, London, on Wednesday and Thursday, November 27th and 28th, 1895. In the absence of the President, the chair was taken by the Vice-President, Mr. J. W. Dearness, of London.

The meeting was called to order at four o'clock p.m., on Wednesday, the following members being present: Rev. C J. S. Bethune, Port Hope; Mr. J. D. Evans, Trenton; Mr. James Fletcher, Ottawa; Mr. H. H. Lyman, Montreal; Rev. T. W. Fyles, South Quebec; Messrs. J. A. Balkwill, J. M. Denton, E. R. Cameron, J. A. Moffat, W. E. Saunders, R. W. Rennie, W. T. McClement and others, of London. A letter of apology was read from Mr. W. H. Harrington, of Ottawa, President of the Society, and a telegram from Capt. Gamble Geddes, of Toronto, regretting their inability to attend the meeting.

Mr. J. A. Moffat, the Librarian and Curator, presented and read his annual report, as follows:

REPORT OF THE LIBRARIAN AND CURATOR

FOR THE YEAR ENDING 31ST OF AUGUST, 1895.

The number of volumes added to the library by gift and purchase during the year was twenty-two. Ten volumes were sent to the binder, but some delay occurred in their return, which prevented their being entered within the year. I considered it desirable to include them in this statement, and in doing so, I had to include several others previously entered, which bring the number added to date up to thirty-eight.

The whole number on the register is 1,399.

The number of volumes issued to local members was thirty-three.

Mr. Fletcher has generously contributed to the library six volumes of the proceedings of the American Association for the Advancement of Science.

Many interesting additions have been made to the Society's collection of native lepidoptera during the year; principally by Mr. C. G. Anderson, one of our local members.

The specimens of *Nemeophila petrosa* received from Mr. Bean of Laggan, have been given a drawer to themselves, arranged in order as upon the plate, with the original numbers attached. The portions of Mr. Bean's paper descriptive of the individual specimens have been placed with them.

Mr. Rennie obtained by exchange cocoons of *Platysamia ceonothi*, and *Antheræa mylitta*, "the India Tussah silk moth," which he kindly shared with the Society. These matured and gave forth their imagoes, which have been placed with the exotic collection.

Respectfully submitted,

J. ALSTON MOFFAT,

Librarian and Curator.

The Treasurer, Mr. J. A. Balkwill, presented the annual statement of the finances of the Society, as follows:

REPORT OF THE TREASURER.

RECEIPTS.

Balance on hand Sept. 1st, 1894	$ 360 60
Members' fees	309 39
Sales of Entomologist	88 56
" pins, cork, etc	66 61
Government grant	1,000 00
Advertisements	21 40
Interest	9 47
	$1,856 03

EXPENDITURE.

Printing	$ 644 33
Report and meeting expenses	216 00
Library	47 38
Expense, postage, etc	117 02
Rent and fuel	102 70
Insurance	28 00
Salaries	300 00
Pins, cork, etc	58 69
Balance on hand, August 31st, 1895	341 91
	$1,856 03

We hereby certify that we have examined the books of the Treasurer and compared them with the vouchers, and find them correct and that the above is a correct statement.

JOHN M. DENTON, } Auditors.
JAS. H. BOWMAN, }

The Treasurer explained the various items of receipts and expenditure and stated that it would require the closest economy to carry on the work of the Society during the remainder of the year. Dr. Bethune and Mr. Fletcher spoke in commendation of the valuable services of Mr. Balkwill and of the high appreciation in which they were held by the members of the Society.

Mr. W. E. Saunders gave an account of the proceedings of the local members of the council with regard to obtaining more suitable and commodious rooms for the Society. After a long discussion, which was participated in by most of the members present, it was resolved that the matter be left in the hands of the local members of the council, who were authorized to take whatever action seemed to them most desirable for the welfare of the Society.

An application from the Senate of the Western University of Ontario was read requesting that their students in geology should be permitted to attend, free of charge, the meetings of the geological section of the Society. After some consideration it was resolved that the matter should be left in the hands of Dr. Woolverton, who is to deliver the lectures, and that he should have the liberty, which is shared by all the members, of introducing friends to the meetings of the section.

The following report of the council was next read and adopted:

REPORT OF THE COUNCIL.

The council of the Entomological Society of Ontario have much pleasure in presenting the following report of their proceedings during the past year:

They have much satisfaction in stating that the membership of the Society in London, and in the Province of Ontario generally, has largely increased, and that additions have also been made to our numbers in other parts of the Dominion, especially in British Columbia. The list of subscribers in the United States and Europe has continued about the same. The total number of names on our books is now considerably larger than ever before since the formation of the Society, while the interest in its work has by no means diminished.

The twenty-fifth annual report on Economic and general Entomology was presented to the Minister of Agriculture for Ontario in November last, and was printed and distributed at the beginning of January. It contained one hundred and twenty-six pages, a larger number than hitherto, and was illustrated with no less than sixty wood cuts, and two full page portraits, one of Prof. William Saunders, one of the founders and for many years President of the Society and editor of *The Canadian Entomologist*, and the other of Mr. A. R. Grote, of Hildesheim, Germany, one of our honorary members and a constant contributor to our publications. In addition to an account of the proceedings at the annual meeting, the volume contains the annual address of Mr. Harrington, the President, and the following interesting and important papers: "Insects collected in Bermuda," by Capt. Geddes; "Common names for Butterflies—Shall we have them?" by Mr. Lyman; "The Butterflies of the Eastern Provinces of Canada," by Dr. Bethune; "The Pitcher-plant Moth," The Gypsy Moth," "The San Jose Scale," and "Injurious Insects of the year 1894," by Mr. Fletcher; "Foods, Feeders and Fed," by Mr. Fyles; "The economic value of Parasitism," by Mr. F. M. Webster; "The structure of the undeveloped wings of the Saturniadæ" and "A reappearance of Pieris protodice," by Mr. Moffat; also a report of the sixth annual meeting of the Association of Economic Entomologists together with a few of the most interesting papers.

The Canadian Entomologist, the monthly magazine published by the Society, completed its twenty-sixth volume in December last. The numbers of the twenty-seventh volume have been regularly issued at the beginning of each month during the current year; the closing number for December is now in type and will be distributed next week. The volume when completed will consist of about 360 pages, and is illustrated by no less than six full page plates and twenty-three wood cuts Among the contributors to its pages are most of the leading Entomologists in North America as well as several in Europe. It is now the oldest monthly publication on insects published in America, and continues to maintain the high reputation that it has so long enjoyed.

A noteworthy event in the history of the Society is the republication, through the kindness of the Minister of Agriculture for Ontario, of the first annual report of our Society, which was prepared by Messrs. Bethune, Saunders and Reed in the year 1870, and published early in 1871. It contains articles on the insects injurious to the apple, grape and plum, and has been for some time out of print. Nothwithstanding that almost a quarter of a century has gone by since it was first issued, the volume is still in demand for public libraries and private collections.

The cabinets of the Society have been carefully looked after by the Curator, Mr. J. Alston Moffat, during the past year, and many valuable additions have been made. The collections owe many of these additions to the zealous work of Mr. C. G. Anderson, who has devoted much time and energy to the lepidoptera in the neighborhood of London. Mr. Bean, of Laggan, has presented a set of the specimens of *Nemeophila petrosa* which were illustrated in the April number of *The Canadian Entomologist*. Mr. Rennie has presented specimens of some interesting silk moths, of which he had obtained the cocoons; and Mr. Rowland Hill a beautiful case of Australian insects.

Mr. E. Firmstone Heath, of Cartwright, Manitoba, has sent through Mr. Fletcher, some interesting and rare lepidoptera captured in his own neighborhood; and Mr. Green, of Osoyoos, British Columbia, has also sent some very valuable and typical representative specimens of butterflies from the Okanagan valley.

The library is steadily growing and now numbers 1,400 volumes, many of them being rare and extremely valuable works.

The report of the Treasurer shows that our finances are in a satisfactory condition. The balance on hand at the close of the financial year is about the same as in his statement at our last annual meeting, and will all be absorbed by the expenses attending the remaining portion of the year. The question of rooms for the Society will have to be dealt with very soon, as the present quarters are too small for the library and collections and the meetings of the sections. It is to be hoped that the new council will be able to settle the matter to the general satisfaction.

The reports of the geological, microscopical and botanical sections are presented herewith. They have held regular meetings during the past season and have accomplished much satisfactory work. The ornithological section has become so much reduced in numbers that no meetings have been held, but it is confidently expected that there will be a revival of interest next year.

The Society was represented by the Rev. T. W. Fyles at the annual meeting of the Royal Society of Canada held in Ottawa in May last. His report is also presented herewith.

All of which is respectfully submitted,

W. E. SAUNDERS,
Secretary.

Mr. Lyman read the report of the Montreal branch as follows:

REPORT OF THE MONTREAL BRANCH.

Annual meeting of the Montreal branch of the Entomological Society of Ontario.

The twenty-second annual meeting of the Montreal branch was held in the library of the Natural History Society, on Tuesday evening, 14th May, at 8.15 o'clock.

Members present: Messrs. H. H. Lyman, President; Lachlan Gibb, Vice-President; Geo. Kearley, and A. F. Winn, Acting Secretary.

The President presented the following report of the Council:

REPORT OF COUNCIL.

In presenting their twenty-second annual report the council have much pleasure in congratulating the branch upon having unquestionably come of age,* and feel that so long a period of continued and unbroken existence is worthy of remark in view of the very small numbers interested in this pursuit.

During the year seven meetings were held and the following papers and communications were read:

An hour at Hochelaga, A. F. Winn.

Notes on the season of 1894, H. H. Lyman.

Note on the occurrence of Pamphila Manitoba at St. Hubert P. Q, A. F. Winn.

Mantis and Mantispa, H. H. LYMANN.

How the forest of the district of Bedford was swept away, Rev. T. W. Fyles.

Note on the occurrence of of *Chionobas Tarpeia* in North America, H. H. Lyman.

Four new memb rs have been added to the branch's roll and it is to be hoped that increased energy will be shown in the study of the many inviting subjects which this department of science holds out to those students who are really in earnest in the pursuit of knowledge.

The Treasurer's report shows that the finances of the branch are in a healthy condition.

Respectfully submitted on behalf of the council.

H. H. LYMAN,
President.

*It was organized 16th October, 1873.

It was moved and carried that the reports of the council and Secretary-Treasurer be received and adopted.

The following officers were elected for the ensuing year:

President—H. H. Lyman.

Vice-President—A. F. Winn.

Secretary-Treasurer—Lachlan Gibb.

Council—G. Kearley, W. C. Adams.

The meeting then adjourned.

LACHLAN GIBB,
Secretary.

Regret was expressed that no member had been able to represent the Society at the annual meeting of the Association of Economic Entomologists held at Springfield, Mass., in August last. Through the kindness of Mr. L. O. Howard a full account of the proceedings has been received, and an abstract will be found in subsequent pages of this report.

Mr. Lyman exhibited a handsome quarto volume containing beautifully colored plates of the butterflies of Germany, which only cost, when delivered here, $4.59. It is entitled "Die Schmetterlinge Mittel-Europas," by Mar Korb, and is published at Nuremburg, Germany.

A paper was next read by Mr. Lyman on *Colias Interior*, the consideration of which was deferred to the following day.

The hour of 6 o'clock having arrived the meeting adjourned.

EVENING SESSION.

In the evening the Society held a public meeting in the City Hall, which was attended by between fifty and sixty persons, for the most part members of the Society. The chair was taken at 8 o'clock by his Worship, Mayor Little; on the platform were Professor C. C. James, Deputy Minister of Agriculture for Ontario, Rev. Dr. Bethune, Rev. T. W. Fyles, Mr. Dearness, Mr. W. E. Saunders and Dr. Roome, M.P. The Mayor opened the proceedings with the following remarks :

Ladies and Gentlemen,—Our city has had the good fortune in recent years to be many times selected as the meeting place of conventions of fraternal and other societies and we are always glad to welcome them in our midst. To-night we have amongst us the representatives of a society, which, though provincial or Dominion in its character, has its headquarters in our own city and is therefore all the more welcome on that account. I am sure, although there are not a very large number present to-night, you will make up by your enthusiasm for whatever you may want in numbers. This Society has been quietly doing a very valuable work in our country. I understand that the journal which they publish is considered the most valuable work on entomology that is published on the continent of America and it is also the oldest. It is all the more interesting to us, because the Society was founded largely through the efforts of Mr. Bethune, who is on the platform to-night, and one of our own fellow citizens, Prof. Saunders, whom though at Ottawa, we still look upon as a citizen and we are proud of him and his work.. I therefore say this Society has a warm place in our hearts, because of its origin, and because it has remained among us. I am sure those who have come out to-night will not regret it.

Without any further remark I will call upon Prof. James of the Department of Agriculture, Toronto, to address the meeting. (Applause)

THE NEW AGRICULTURE.

By Mr. C. C. James, Deputy Minister of Agriculture.

Mr. Chairman, Ladies and Gentlemen, and members of the Entomological Society, I believe it is somewhat of an innovation for the Ontario Entomological Society to hold an open meeting, or as we sometimes say a popular meeting, in connection with its deliberations. This, I take it, will have the effect of bringing the Society more into sympathy with the people, or rather of bringing the people more into sympathy with the workings of the Society. As a rule we find that the best men do their work most quietly. The men in this world who do the most advertising of themselves, who create the greatest stir for the time being, are not always the most important men in the world. So with regard to many of these societies, those who are doing their work the most quietly are very frequently the ones that are doing the most important work for the community. And the very fact that this Society for twenty-five years has been carrying on its work by

itself, quietly, without creating very much stir, is not a condemnation of the Society, but, to my mind, the very fact that it is able to live after years of this quiet life shows it has that true vitality which will enable it to exist and to do good work in this world. (Applause)

We are not very many who are gathered here to-night, and what we have to say will be more in the line of a quiet talk between ourselves, more or less of a conversation one with another, with regard to the work in which we are interested. I propose to talk in regard to general agriculture and in connection with my remarks I may have something to say in regard to entomology and its relationship to agriculture. I do not consider that there is any more important question to be discussed or studied by city people, as most of you no doubt are, than this subject of agriculture. Some one may say that agriculture ought to be reserved for farmers and farmers' sons and families, and that the bringing in of the subject of agriculture at a town or city meeting is a great mistake. But there are two or three reasons that we can offer in connection with this, that are quite sufficient to warrant us in introducing a subject of this kind. In the first place we all admit that this country is first and foremost an agricultural country, that the progress of this country depends more upon agriculture than upon any other industry and that just as agriculture rises or falls so will the general prosperity of this country rise or fall with it. When the farmer is prosperous, has good crops and good prices, the people in the towns and cities feel the effect; and depression in the country is felt very soon in the city. Then again there is an old idea, now being rapidly removed, that agriculture after all is not a very interesting subject. The principal reason of talking to.night is to endeavor to show to you, in an indirect manner it may be, that after all there is a great deal of interest in agriculture for the people of our towns and cities.

There has been more or less talk of teaching agriculture in the schools and some have said it should be taught in the rural schools, but there are many people in this country who have looked into this question and who after thinking over it carefully have come to the conclusion, that agriculture should be taught in our city schools as well as in the country; that there is as much need for the education of our city pupils as for the rural in the subject of agriculture. Perhaps I may be able to show you, in a few cases at least, that agriculture is not that dry hum-drum business that many of us have sometimes thought it to be, but that connected with it are some of the most important and interesting questions that have presented themselves to the mass of human beings. We have heard a great deal of late in regard to many of the new questions, the *new woman* for instance has filled column after column of our city papers. Now it struck me in looking around for a subject that possibly I could not take anything better than this "*the new agriculture.*" (Applause.)

What are the changes that have taken place, or what are the forces that are present that have given us and are giving a new agriculture?

The first is the great increase of transportation facilities. Those of you who are older than the speaker here to-night will remember the time when transportation between the old countries of the world and this country was very slow. To-day we have the great continents connected by lines of steamers that run as rapidly as some of the accommodation trains upon our railroads. Nearly every continent in the world is belted by one or more great trans-continental railways. Even Russia is about completing a great trans-Siberian railway, Africa will be the next country to have a trans-continental railway. The result is that the world, so to speak, has been shrunken up and although we have these continents at distances of five to eight thousand miles apart and although we have great stretches of country such as this North America of ours, still with the improved steamship lines and railways, these countries have been so closely brought together that practically this world is now simply one great continent or one great country. What has been the effect of that? The effect has been that the great consuming markets have been brought closer to their sources of supply and it is not very much of an advantage now to be stationed a thousand, or two, or three, or four thousand miles nearer to the great consuming centres of the world, than some other countries. For instance Canada, because she is only some four thousand miles from England has not a very great advantage over Australia which

is, I think, some twelve thousand miles away. South America is practically as close to Europe to-day as we are. Africa, both in the north and south is about as close to Europe as we are. There is very little difference in the cost of transportation over these great ocean distances and the result of it has been, that these countries with great territories of fertile lands, and with cheap labor, have been able to produce with almost equal facilities the enormous quantities of crude materials, such as wheat and oats and barley, and as a consequence the great consuming countries of the world are supplied as they have never been before. And the prices of these products have been going down lower and lower until we find that one great result has been that these crude products of the farm have been brought to the great commercial centres at very low rates Let me give you a couple of instances. It costs about thirty-four cents to pay all charges for sending a bushel of wheat from Manitoba to Liverpool, let us say half a cent on a pound. From Australia butter has been shipped to London at a rate less than two cents a pound. The transportation charges have been brought so low that it is possible to ship butter in refrigerator steamships from the dock in Australia to the dock at London for a smaller amount than it can be sent by rail from the north of England to the south. So that you see the great increase in transportation facilities has reduced distances; has brought the great producing nations of the world closer to one another, and they can now barter in the markets at about equal advantage one with the other. The result of this has been that the products that are of easy production have suffered in price as a consequence, and only those products which are more difficult to produce, which are produced by the more highly cultivated people, by a people with better facilities, with better training and better education, have been able to hold their own. Our farmers to-day are turning their attention more and more to the production of these higher classed articles, these articles which require more skill, because thereby they come less and less into competition with cheap labor and cheap soil. The production of these lower grades brings their higher priced labor in competition with lower priced, whereas the production of the higher classes, such as the best class of fruit and dairying production brings them into competition, not with cheap labor and cheap lands, but with the better class of labor and lands of Europe.

The second cause is the application of machinery. This perhaps might not at first sight present itself quite as forcibly to your minds as it will if I give an instance or two. The grains as we grow them, such as wheat and barley, have been raised from time immemorial. It is impossible to say when wheat and barley and grains of all kinds were first produced upon the earth. Go back as far as you will, you will find in history and in archæological remains the traces of the instruments for cutting have been shaped something like the curved arm, the sickle, and yet if you think, it was only the other day the sickle went out of use among civilized people. From the time that wheat and barley and oats were first produced until within a few years ago, the sickle, with practically little or no change, remained the sole reaping instrument of the human race. About 1826 a Scotch minister presented for examination to the Highland and Agricultural Society of Scotland a new machine, the forerunner of what we now know as the reaping machine. About the year 1831 Cyrus MacCormack brought out the first reaping machine in the United States. It was not until the year '41 or '42 after ten long years of experiment and changing and testing that this machine was finally put upon the market. It is only within the last fifty years that the sickle, the scythe and the cradle after being used for so many centuries have been superseded by the reaping machine. All at once what wonderful developments began. The reaper and the mower, and then a very few years ago came the self-binder, and we have to-day in California the harvester and header machine, drawn by from eighteen to twenty-four horses or mules, which reaps and threshes the grain and leaves it in bags on the field. The question we ask ourselves right here is, "What next?" One hesitates to say or give an answer to that question when we see what has happened, what wonderful steps in progress have been made from the simple sickle or scythe to the self-binder. When within the period of thirty or forty years such wonderful evolution has taken place after a long period of quiescence, one may say, what will be introduced next?

Take another instance. In connection with dairying the method in olden times of churning the milk was by a very simple operation, either by means of a bag hung up and

pounded or swung around, or else in a vessel quite similar to our old-fashioned barrel churn. It is not very many years since the old-fashioned dash churn and implements of this kind were used for the manufacture both of butter and cheese. Then someone introduced the application of power, such as horse power, steam power, the introduction of the box churn and one after another applications of the various kinds of machinery began to be made, till now what have we to-day? We have a machine that can be set up in the barn to milk the cows. Although this machine is in an undeveloped condition, nevertheless it does its work and proves we are on the right track. That milk drawn by a machine can now be put into another machine and by means of it the skim-milk comes out of one spout and the cream out of another. This cream can be put into another vessel or machine, and by proper temperature and the addition of a substance somewhat resembling yeast, a fermentation can be started, and just that kind of fermentation that we desire in connection with it. After the fermentation has gone on a certain time this can be put into another machine and churned, and after churning it can be worked and packed by machinery. So that now it is possible, although not altogether practical, from the very milking to the putting of the finished article on the market, to do the whole of the work by machinery. This wonderful progress has taken place within the last quarter of a century.

As we look at farming in its different aspects, machinery has been applied at this point and that point, and agriculture is being put on an equality with the manufacturing establishments of our towns and cities. You ask yourselves this question, "Why have our great manufactures in the towns and cities developed?" The principal reason for this is in the application of machinery to the work. Why is it that machinery has been developed in connection with all these other industries and yet it has taken so long to bring the attention of inventors to the work of agriculture? Well, one reason is that there has been no great necessity for it until recent years. We sometimes hear it said that the men are leaving the farms because they are not required, because so much machinery has been brought in that a man with a machine can now do as much work as a man and two hired men could do before. There is another side to that question, viz., because of this drawing away of so many farmers' sons from the farms to the towns and cities, because of the want, therefore the supply of machinery has been produced. Both of these things no doubt have been effective. That is, machinery has been produced because it has been required; and people have left the country since they were not required because of the presence of machinery. According to the census of 1891 there were farmers and farmers' sons in Canada to the number of 649,506, in 1881 there 656,712. From '81 to '91 the number of farmers and farmers' sons in Canada decreased by over 7,000, yet during that period we had the opening up of Manitoba and also of the North-West, and the agricultural product of Canada is greater to-day than it ever was before. If you put these two or three facts together you can easily see the great part machinery has been playing in connection with agriculture in Canada for the last ten years. Although the number of farmers decreased to the extent of 7,000, nevertheless the total output of agriculture has vastly increased. This is owing to a great extent to the application of improved machinery in connection with agriculture.

The next point in connection with agriculture that I wish to refer to is one that comes as a sort of rider to the last; a companion to it, namely, the application of science to agriculture. Now, in certain quarters the moment you begin to talk about the science of agriculture and scientific farming an objection is raised and people say there is nothing scientific about it, it is all practice, and when you find a scientific farmer you find a farmer who does not make much progress.

I desire to give a few facts to show that science has been applied quite successfully to the improvement of agriculture in this country, and further, that just as we bring to bear upon agriculture the latest and best developments of the different sciences, so we may expect agriculture to make improvement. One of the great reasons why agriculture remained on a dead level for so many centuries was simply because the attention of scientific men had not been directed to agriculture as a field for investigation. Scientists had been expending their time and energy with the work that is carried on in

towns and cities. To-day we find as much attention being paid to the science of the calling of agriculture as to anything else, and the result has been wonderful progress, a wonderful development, which has begun of late and which is now in progress, and the result of which we can hardly forecast at the present time.

Let us take two or three illustrations: We sometimes hear it said that there is not very much in agriculture, that it is a dry subject, with nothing interesting in it, that it belongs so to speak to the common people and not to the literary class; there is nothing about it likely to attract the attention of people. Now, I will give you an illustration, which probably you may have had presented to you before. It has been known for years that there is wonderful difference in different crops, in the methods of their feeding. For instance, they say clover will feed in one way, that wheat will feed in another, that our common grasses of the field feed in another, and because of their different methods of feeding, therefore, it is advisable that we rotate crops, one kind one year, another kind another year. We can perhaps illustrate that by representing before us here a large table. Suppose a long table were set up in this room, filled with all manner of food, and you as an audience were asked to sit down at the table to partake or taste, and to take all you would want to eat. No two of you would want to eat the same kind of food. One man would have a preference for fruits; another man might have a great preference for meats; in fact there would be a choice in the kinds of meat. Your tastes differ; your methods of feeding differ. After you were through, if you will allow the comparison to be taken to a little lower level, suppose we were to bring in some animals of another kind whose tastes were different from ours, they would be able to take from what was left. Still there would be a portion of the food they would not take, and we could bring in something else and finally the scraps might be thrown out to the poultry. So if you alone were to be fed upon that food there would be a considerable amount that would not be taken; you could not make use of it, but what you did not want some other animal would devour; what the second class of animal would not devour the third would. Here is a large feast, so to speak, prepared by nature for plants, and we put one kind of plant upon that soil this year. It has a preference for a certain class of food and takes it, and next year another kind of plant is put upon that field which has a different feeding capacity from the one of the preceding year and that plant takes what the other one does not want, and so on by rotating year after year, for three or four or five years, we are able to satisfy the wants of all, whereas if we kept on with the one plant year after year, we would have exhausted the particular food of that one plant and the rest of the food that was there would have been left lying idle all the time. Many farmers in years past, thinking the soils of this country were entirely inexhaustible, put in wheat this year and wheat next year and so on, until finally they were forced to the conclusion that there was nothing left for the wheat and they have taken their attention to other things. We find in many cases what was once a first-class wheat farm became a very poor wheat farm, and then after a number of years that poor wheat farm has become a first-class dairy farm, because different crops have been grown for milk, butter, and cheese.

I want to refer more particularly to one of these plants, viz.: Clover. I do not think there is any plant that presents a more interesting study, interesting though they all may be, than this much neglected and underrated clover plant. It was found that it fed in a different way entirely from the wheat, and then the question that presents itself to the minds of some of these much despised scientists is, in what way does that clover plant live? How does it differ in its feeding from other plants? After a long and careful examination, some came to the conclusion that it got most of its nourishments out of the air. Others concluded because it had a long root and it could go down into the sub-soil, that it got its nourishment there. They finally found something that had escaped the attention of most examiners, in connection with the roots of the clover plant upon which there were little knots or nodules. Now, I suppose hundreds of thousands of clover plants had been examined and these little knots had been seen. Someone who was a little more inquisitive pushed his question a little further and began to ask himself this question seriously: "Now this little bud or nodule on the roots must after all play some part in the economy of this clover plant." And to sum the whole thing this has been the

result of investigation; that these little knots are filled with very minute organisms very difficult to describe, very minute specks somewhat similiar to the very minute specks we find in yeast These are living in the roots like little parasites and the effect of their living there is to take up nitrogen from the air and in some way to give it to the plant for its subsistence, so that whenever one of these nodules comes on the clover root we find it has the means of taking up food out of the air, and then when we turn over the plant and allow it to decay in the soil, we put in the soil a certain amount of food that this plant has taken up out of the air; and the result of it is there is an excess of food there for the next plant that comes along. Now the wheat does not possess that little nodule and it does not take up the nitrogen out of the air, and the result has been that, that little investigation,—little we may call it, yet momentous in its results—has established the practice of preceding the wheat crop by a crop such as clover, or peas or beans.

Let me give you one instance in connection with entomology which has seemed to me since I read it some years ago, almost like a fairy tale. I will give it to you just as it stands. About eight or nine years ago the complete destruction of the orange groves of California was threatened by the spread of an insect known as the cottony-cushion scale. This insect was covering the limbs of the trees and the result was the vitality was being sucked right out of these trees by millions of tiny insects. The pest got completely beyond the control of the fruit growers of that country and in their despair they appealed for help to somebody or anybody. Professor Riley who was in charge of the Entomological Department at Washington, and who unfortunately met his death this year,—one of the greatest benefactors the American people has ever known—at once began the investigation of that question. Being an expert entomologist he knew practically every country in the world where that scale insect was common and he knew that the most likely place from which it had come was Australia. It had probably been introduced some twenty years before that, in bringing in fruit trees or vines from Australia. He however knew it had never become a pest in Australia. Now if it is found in Australia and later found in California and has become a pest in California and has not become a pest in Australia, he concluded that there must be something in Australia that will stop it, so he despatched two assistants to Australia to investigate it and they sent back consignments of lady-bug beetles or lady-bugs as they are commonly known. You have seen these running back and forth over the leaves and branches of the fruit trees doing great destruction to the other insects. Within a very short time, less than a year, although these scale insects had been increasing for twenty years and practically had the products of California by the throat, and in fact had taken possession of the country; in less than a year, this little lady-bug increased to such quantities that it swept the scale out of existence or got it into such control, that the fruit interests of California were saved. (Applause). I do not suppose that anybody could sit down and figure up the amount of money that was saved or made for the United States by that simple little insect brought in by a man known to very few present. You do not see his name prominent in the newspapers. The fact was not heralded broadcast in great flaming type. He was not given any great ovation. It is a question whether any monument will be erected to him by the United States, yet it is doubtful whether the United States has had any greater benefactor than that man and his associates.

Take the potato bug, what would we do to-day if we did not know that simply by dusting Paris green on potato plants we could effectually head off and kill the potato beetle. We could not raise potatoes at all. Where has that come from? It was not picked up by chance, somebody did not sit down one day and write to the paper that he thought that if you dust the potato bug with Paris green you would stop it. Back of that was careful investigation by these same men who study the habits, mode, and living and all about the potato bug. We might go on and give instance after instance. A great many of the various methods that are being practised to-day, many of the best practices we have in connection with agriculture to-day have come, not by hap hazard or by chance, but have been worked out by men on small salaries, working in obscure places, who have devoted themselves to their work with such energy as we have not had surpassed in any other calling, I care not what one you mention.

What a large portion of our reading is monopolized by a few things. I suppose the people of London know how much importance is attached to politics. It seems to be necessary the world over to have politics, but there are other things that are constantly filling the newspapers. What does that prove? That the people want to hear about these things, that the people have their attention taken up with these things, yet it is not very often that you find the most valuable columns of the newspapers given over to some great agriculture event, unless it may be in the case of agricultural depression or crop failure where there is something that is going to effect the finances of the whole country.

The point I want to make is this, there are lots of things happening in connection with agriculture, that are far more important to the prosperity of the country than these things which seem to occupy such an important place in connection with public attention. I have brought along with me a picture to illustrate that. Last summer, many of our Canadian papers were interested in a discussion, as to whether the American Society of Colonial Wars should be allowed to go down to Louisburg, Cape Breton, and erect a monument to commemorate the taking of that place by the Americans, British Colonists, as they were at that time. If I remember correctly some 150 years ago they occupied the place and held it for a short time, and then the French people took it back again. Now that event has cropped up again, after a period of 150 years. That event has been made so important to a large class of the community that they felt themselves constrained to raise a large fund, to get together a large excursion party, and to journey to Louisburg and erect that monument. It created so much attention at the time that it was a matter of doubt as to whether the Canadian Government ought to allow these people to go over there and erect the monument or not. This picture was sent me by Mr. Thompson, of Massachusetts, and I will just read you the inscription upon it. It is doubtful whether half a dozen in this room have ever seen this in the newspapers, or whether they know such a monument was erected. "This pillar, erected in 1895 by the Rumford Historical Association, incorporated April 28th, 1877, marks the estate where in 1793 Samuel Thompson, Esq., while locating the line of the Middlesex Canal discovered the first Pecker Apple Tree, later named the Baldwin." Now, I will submit it to you as to whether it was of more importance to the country to capture and hold for a short time, that little point down there on Cape Breton, or to discover the "Baldwin Apple." That Baldwin apple was discovered in 1793, and at the present day if you pick up in the fall of the year, just about this time, the market reports in Liverpool, you will find a few kinds of apples mentioned. Greenings so much a barrel, Spies so much, Baldwins so much. Practically from that day to this the Baldwin apple has been produced over the Eastern and Western States, and in Canada, and has been bringing in year by year a large amount of money to the American people. And yet events of that kind are practically lost sight of; whereas events such as I have spoken of, are blazed forth to the country and the minds of the people are filled with it. Now it seems to me these things are out of all due proportion. Probably we cannot rectify them, yet the point I want to make here is that there are a great many things happening, there are a great many conclusions being arrived at in connection with the prosperity of this country that are entirely overlooked, whereas other events that are of little consequence after all, are magnified and fill column after column of the newspaper. What is the result of this? Suppose you ask the boys and girls in the rural parts, and the boys and girls in our towns and cities, what effect the reading of these matters has upon their minds? Is it not a fact that it suggests to their minds the paramount importance of politics and such things as concern town and city life. The result is their minds become filled with the events of town and city life; their inclinations are drawn off in that direction; the ties which bind them to agriculture become cut one after another, and the ties which lure them away become greater and greater, till we find a great many of these, to their discomfort afterward, are lost to agriculture and a great many men who would have made first-class agriculturalists, are drafted off in other lines of work to take second and third-rate positions.

The last point I desire to touch upon in connection with this new agriculture, is that during the last ten or twelve years, to say nothing about the past twenty-five years,

there has been wonderful development in connection with the facilities for acquiring information in regard to agriculture. These things that I have mentioned I have no doubt will be righted some day, and before long you will find the histories of this country will not be filled merely with accounts of men killing one another, they will not be filled merely with the names of persons who have occupied positions in towns and cities, but you will find there the development of the people traced. A gentleman came to me the other day who had for sale a book, dealing with the history of this country. He said: "You will find there everything in connection with this country." I said: "I will be very glad to get it, I have been looking for a great many things and have not been able to find them." Now, before you go away we will just try it. I said: "When was the first Agricultural Society formed in Ontario? "I don't know," well, I said, "that is of importance, is it not?" Is there any organization or institution that has done more to build up and develop the country, until probably within the last four or five years, than the Agricultural Society? It is of as much importance to know as when a certain kind of industry was established in some town or city. I have been on the search for it for the last five years, and finally I think I have nailed it down. There is an utter absence of all these facts in regard to the agricultural development of the country. Until we come down to the period of twenty-five or thirty years it has almost all disappeared. They can tell you of the men who have been elected to Parliament from the very first up to now. They can give you the vote that was polled in connection with any election. They can tell you, perhaps, when a certain new kind of machinery was brought into the country. They cannot tell you when the first improvement was made in connection with live stock, when the first thoroughbred live stock came into the country. I say that it is of much importance to know when these agricultural industries began and how they developed, because on these, rather than the others, the prosperity of this country has been built up. My point is, there ought to be a proper balance between these things and our histories should not be filled with other events to the exclusion of those which are equally important.

A wonderful change has taken place in the facilities for carrying on experimental work and getting an agricultural education. Take this province, we have the Agricultural College at Guelph and the Experimental Farm at Ottawa, from which our friend Mr. Fletcher comes. We have a school or college of agriculture at Kingston, and now we have a dairy school in the west at Strathroy, so we have four points in this province from which comes information in regard to some of the later developments in agriculture. Then we have six or eight different points at which experiments in connection with fruit growing will be carried on, and there is a great development along that line. Before long we will have this province dotted over with little stations from which the latest information may be obtained, and each of these will be a centre leavening the whole surrounding country.

Then we have the societies. Beginning with the time of the organization of the Province of Ontario in 1867, we have from then on had the organization of society after society, till now we have three dairy associations, two poultry associations, the fruit growers, the bee-keepers and the sheep-breeders and the swine-breeders, and a great many other stock associations, and last, but not least that association to which we are indebted to-night for this meeting, the Entomological Society which has now been carrying on its work most successfully for the last twenty-five years. I think these societies have all been accomplishing a great deal of good in this country. Some may say they do not get any great benefit, they do not come in immediate contact with the Entomological Society, but each one of these men so to speak becomes a source of information and as they go from these meetings to their homes, to this point and the other, they give out their information. They also come in contact with other men through their writings.

This Society has been quietly doing one of the most important works in connection with agriculture in this province. If these gentlemen were not present I might say something even a little more flattering with regard to them. I have had occasion from year to year of examining the reports of their meetings which they have sent out, because they are published in the department to which I am attached and I can simply say this,

that if the work of all the other societies was as well done as the work of this Society our labors at Toronto would be very much relieved. When the report comes in it is ready at once to go to the printer and we have no further work in connection with it, and year after year when I read that report I have been astonished with the amount of work that has been condensed and packed away. It is not a padded report, it is a report full of information. In looking over the list of persons to whom it is sent I find it has gone to almost every corner of the world. These men have not been content to hide their light under a bushel, but their work has gone out into every province, and has gone out into the whole world. Someone may say, "I do not see any good in finding out what is the peculiarity of certain insects or finding out just how they live." I do not see any good result coming from the work of the bacteriologist who studies with the microscope things small, so that if you were to take up a drop of milk on the point of your penknife and were able to count its inhabitants you would find 1,000,000,000 of these living plants in that drop of milk. The whole system of dairying has been revolutionized by the work of that man who is sometimes called unpractical.

Whenever I hear any of these objections I sometimes think of a saying of Franklin. Franklin you remember in connection with his experiments in electricity sent a kite into the clouds. He told the people that there was electricity up there and they laughed at him. He sent up his kite but the electricity did not come down. However, fortunate for the occasion, we are told, that the kite went up into a black, dark cloud which he positively felt was filled with electricity. Shortly afterwards the rain began to fall. It came down wetting the kite and trickling down the string. Then the hand that held the wet string began to feel the throbbing of the electricity; he proved it to them and they said. "What is the use of it?" And he said. "What is the use of a baby? It will grow to be a man." So in regard to many of these inventions or discoveries or conclusions that the entomologists, and chemists and botanists, and bacteriologists, and biologists and other scientists may find with regard to agriculture. Their discoveries are in the condition of Franklin's baby, and if we will only wait and have faith in the work we are engaged in and give true encouragement and sympathy, some of us at least may live to see these scientific babies grow up to be good, strong, stalwart men in connection with the practice of agriculture in which we are so much interested. (Applause).

At the conclusion of Prof. James's address, which was listened to with great attention and heartily applauded, Dr. Bethune rose and said:

Mr. Mayor, Ladies and Gentlemen,—I propose that we offer our very hearty thanks to Prof. James, for the able and interesting address which he has just given us. Prof. James has come, I am sure, at a grest deal of inconvenience to himself on purpose to be present with us here to-night, and to encourage us by the remarks which he has made, and also to give us a great deal of very valuable information. While thanking him for his address to-night I should also like to take the opportunity, as one of the original members of this Society, to express the gratitude that our Society must necessarily feel towards the Department of Agriculture for Ontario, of which Prof. James is Deputy Minister. He has remarked this evening that our Society has been in existence for twenty-five years and the Mayor has also mentioned to-night, that our magazine, *The Canadian Entomologist*, is now the oldest magazine touching on the subject, upon the whole continent of America. But I wish to let you know one reason why our Society and our magazine have survived so many others that have have started in the United States and Canada and that is, that we have been so greatly helped throughout nearly the whole of our existence, by the Department of Agriculture for Ontario. (Applause.) We began in a very small and humble way with a little magazine of eight pages that was to be published whenever we had enough material and enough money, and we had fourteen members, all told, when we began. And we managed like many other societies to struggle on, but unlike most societies of this kind, we have not died a natural death in a few years. The Department of Agriculture came to our assistance, and gave us a small grant at first, which was subsequently greatly increased, so that while a number of years

passed, we have been able to hold our own in the domain of science in North America and to spread our publication, not only all over the continent but, we may safely say, to the ends of the earth. We have correspondents and subscribers in every part of the world, including even South America, Australia, India and Japan, as well as the different countries of Europe. I trust you will unite with me in expressing our thanks to Prof. James. (Applause.)

THE VALUE OF ENTOMOLOGY.

Mr. James Fletcher, Entomologist of the Experimental Farm at Ottawa, spoke as follows:

Mr. Chairman, Ladies and Gentlemen,—It is my pleasure and honor on this occasion to represent as well as I can a far better man than myself, namely, the President of our Society. After all the kind words which have fallen from the lips of our esteemed lecturer of the evening, the Deputy Minister of Agriculture, it is difficult to give a resume of the work and objects of the Entomological Society of Ontario without repeating something which may already have been better said. Our Society stands in the position of a Division of Entomology to the Department of Agriculture and Arts, and it is the wish of every member of the council that our work should be of the greatest possible utility to the country at large. The work done in the past has been of an excellent nature, the prosperity and utility of the Society having year by year increased, and I am happy to be able to say that, at the present time, the Society is in a more prosperous condition than it has ever been before. We have a body of active, enthusiastic workers and every equipment for good work—valuable collections of insects, as well as a first-rate botanical collection, a magnificent library, and, in addition, active branches working up not only entomology, but also many other kindred branches of science. The condition of our library is rather remarkable. It is undoubtedly the best library of works on natural history in Canada and one of the best in North America. Now I am quite certain, Mr. Mayor, that the citizens of London are not aware of this fact; they do not know of the valuable collection of books on natural history and the grand museum of insects and plants which are deposited here in their midst, but which specialists are glad to come from all parts of Canada to examine. Some people may say, "What is the use of these collections of insects and plants? They are pretty, it is true, but what is the use of them?" In reply, I would remind such enquirers that these objects are but means to an end. The main object of our Society is to prevent loss to the farmers of Ontario from the attacks of insect pests. The enormous losses which take place in the crops of the province every year from the depredations of injurious insects, can only be controlled by specialists first studying up and understanding the habits of the insects which cause the damage; for this purpose collections of various orders of insects for study and comparison are essentially necessary. Moreover, by collecting and studying all the members of a family, we may frequently anticipate and prevent injury by one species from knowing the habits of an allied member of the same family. We aim then to make our collections as complete as possible and look forward to the time when some day we may have in our cabinets representatives of all the injurious insects which have given trouble in Canada. These are matters of interest to the citizens of London, which place has always been the headquarters of our Society; and my advice to those of you who have not yet found out what treasures you have among you, is to go and find out as soon as possible; it is worth your while, and I can promise you that you will at all times meet with a courteous reception from our Curator, Mr. J. Alston Moffat, who will gladly show the many beautiful objects in his charge to anyone who is interested enough to call upon him.

Some striking instances of the usefulness of the study of entomology have already been well laid before you by Prof. James, and there are numerous others which might be cited. If any proof of the matter were needed, we have merely to think of the large number of official economic entomologists employed by the leading nations of the world,

and to notice how the study of injurious insects is fostered by the most practical people on the globe to-day, the Americans, who indeed were the first to organize a systematic study of practical entomology and fungology. These two branches of knowledge are certainly worthy of much study, for they are the two chief causes of a reduced output, in other words, loss of revenue, in every country of the world.

The losses in the agricultural produce of a country every year due to the ravages of insects are said to be ten per cent. of the whole amount, and there is a further loss of ten per cent. caused by fungi parasitic on plants grown by man as food for himself or his stock. Familiar examples of such parasitic fungi are the black spot of the apple, smut of wheat, oats, barley, etc., grape mildew and potato rot. All of these are diseases which in the past have been the direct cause of the loss of large sums of money, but which now, owing to the studies of specialists, can all be to a large measure controlled by practical methods, cheap, simple and effective, which can be used by every farmer in the country possessed of ordinary intelligence. The same thing is the case with injurious insects. Of those kinds which every year attack our crops and reduce our revenues, by far the larger proportion have been studied out so fully, by men such as those who form the membership of the Entomological Society of Ontario, that at the present time practical remedies are available for all who will take the trouble to ask for them or who have kept themselves posted in the matters which concern vitally the success of their business. But these facts are not appreciated generally by the people most concerned, the agricultural classes. It is an old but true saying:—"We only miss the water when the well runs dry." As a rule, farmers only think of remedies when they find their crops seriously attacked, and they then find that in many cases it is too late to prevent loss. Many of the most successful means of protecting crops are methods of prevention and must be put in practice long before the crop to be protected has reached maturity. The farmers of Canada are much to be envied; for they have advantages not surpassed in any part of the world. Yes, sir; not only have we here the glorious climate and magnificent soil necessary for the production of the best agricultural products; but we have as well wise Governments who are doing everything possible to help us in making our operations successful. We have our most active and useful Department of Agriculture, at Toronto, which publishes every year in its annual report, the latest developments with regard to all subjects brought before the various societies subsidized by the Government; these deal with many different agricultural matters, such as our own Entomological Society of Ontario, the Fruit Growers' Association, the Bee-Keepers' Association, the Sheep and Swine-Breeders' Association, Farmers' Institutes and many others. All of these associations receive grants, and the Government publishes their reports for the good of the farmers of the country. Besides this, we have the Agricultural College at Guelph, a grand institution doing excellent work; and, above all, we have the Dominion Experimental Farm system maintained by the Federal Government, which is constantly at work trying to assist the farmers of Canada by testing and examining all subjects which it is thought may better their position and prospects. The publications of all these institutions are issued free of charge and distributed with a liberal hand. In fact I believe, as I have already said, there is no country in the world where more is being done in a wise way to help farmers than is the case to-day in Canada. (Applause.)

Is it not folly then on the part of any man in this country not to apprise himself of these facts and put them in practice? To bring the matter back again abruptly to the work of the Society under whose auspices we are gathered here to-night, is it not folly on the part of any farmer in Canada not to find out what are the latest developments—or, as Prof. James has put it, "what is the new agriculture,"—with regard to the best methods of protecting himself from loss and of saving his crops from the attacks of the hordes of injurious insects which are ready to levy so heavy a tax upon all that he grows!

Many instances might be cited of the good results which have followed the diligent work of entomologists.

Prof. James has already referred to that delightful incident by which the very existence of a lucrative industry, the cultivation of oranges and other citrus fruits in California, was saved from extinction. This was done by the timely introduction from Australia, by the United States Entomologist, Dr. C. V. Riley, of a small parasitic lady-bird beetle (*Vedalia cardinalis*, Muls.) which preyed upon the injurious Fluted Scale *Icerya Purchasi*, Maskell), Fig. 1, an insect which threatened at one time to destroy all the orange groves in the Pacific States. Another instance of good work of particular interest to Ontario farmers, was the practical remedy first hit upon by Mr. L. O. Howard, now U. S. Entomologist, for fighting the Clover-seed Midge. Our farmers in Western Ontario now cut or feed off the first crop of clover about June 20th, to prevent injury to their seed crop by the Clover-seed Midge. This is undoubtedly the best method of preventing loss, but they do not think that the knowledge of that one fact, which is worth at least half a million dollars a year to Canada, was due to the carefully studied investigations of one man. They know nothing of the arduous and unremitting work which was necessary before

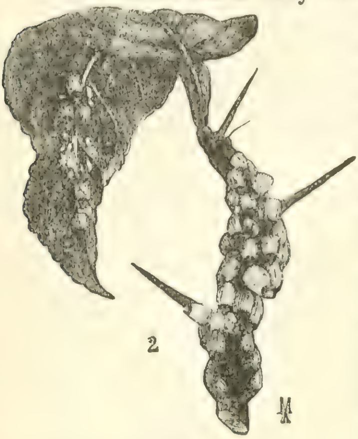


Fig. 1.

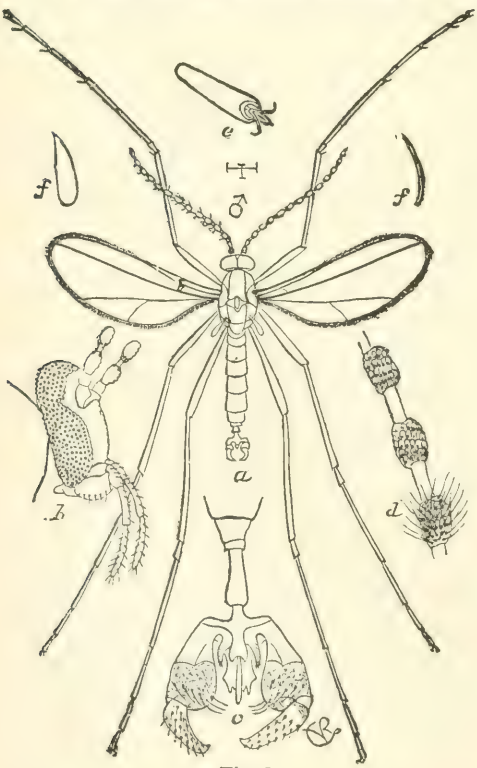


Fig. 2.

Fig. 3.

the different dates at which the insect passed through its various stages, were definitely fixed; but, when this was done, it was at once possible from this knowledge, to suggest an easy and very effective remedy. The Clover-seed Midge is a minute gnat

(Figs. 2 and 3) which lays its eggs in the forming flower heads of the clover plant in May or early in June and again during July. There are thus two broods of this insect in a season. The larvæ (Fig. 4) of the first brood attain their full growth about the end of June, when they leave the clover heads and go into the ground a short distance to complete their transformations, the perfect flies appearing about the middle of July. The eggs laid by these midges produce the second brood of larvæ which destroy the fall crop of clover seed. Part of this brood matures in September, but the remainder not until the following spring. Experience has taught farmers that the remedy suggested of feeding off their clover fields with cattle and sheep until the beginning or middle of June, or cutting it by the 20th of the same month, is the only way to secure an autumn crop of seed; thus, the grubs of this first brood (the eggs of which were deposited on the growing clover as the heads formed) are destroyed by the cattle eating them, or they dry up with the clover hay which has been cut before they were mature enough to leave the heads of clover and go into the ground to complete their stages. If the clover is left standing in the fields till the end of June, a sufficient time elapses for this latter process to take place, and the perfect flies emerge again just in time to lay their eggs in the opening flowers of the second crop. In this way, the seed of the second crop is destroyed as well as the first.

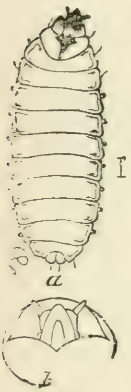


Fig. 4.

Few appreciate the fact that many of the common remedies which have now come to be pretty generally practised all over Canada, were the outcome of much labour and unremitting attention on the part of men who had devoted years of close study to the matter. The farmer who saves his crop of potatoes by dusting or sprinkling them with a mixture containing Paris green, has small thought for the continuous effort and numerous trials which were necessary before the insecticidal properties of this useful substance were discovered. Paris green, the standard remedy against all mandibulate or biting insects, is a chemical combination containing chiefly arsenic and copper, about 60 per cent. of it being arsenic. It is to this latter it owes most of its virtue as an insecticide. It is, I think, almost an ideal material for the purposes to which it is applied by entomologists. The danger of its being mistaken for some other substance of a harmless nature is reduced to a minimum by its characteristic bright green colour, the colour green being very generally recognized as indicative of poisonous properties. Its insolubility in water and under most conditions to which it is likely to be exposed, renders its use very simple, although this fact also necessitates the constant agitation, during their application, of all liquid mixtures containing it, in order that the Paris green, which is very heavy, may be kept in suspension uniformly through the whole liquid. Its fine state of division makes its dilution either with liquids or dry powders very easy, and its extreme virulence as a poison makes it possible to dilute it very much indeed without loss of its efficacy as an insecticide. It has been discovered of late years that, by mixing an equal weight of quick-lime with this arsenite, the caustic effects which sometimes follow its careless use on vegetation, can be in a large measure prevented. This discovery has simplified immensely the question of the most suitable remedy for mandibulate insects; for now a standard strength of one pound of Paris green, one pound of quick-lime and 200 gallons of water may be recommended for use on all kinds of vegetation. If it be thought more convenient to apply the poison in a dry form, it may be mixed with fifty times its quantity of any dry and finely divided powder.

The easiest way of applying Paris green to orchard trees is in a liquid mixture, by means of a force pump with a spraying nozzle. The good results which have followed the adoption of spraying as a regular orchard operation, have been so remarkable that it is now practised by all progressive fruit growers. There are various kinds of spraying

* Fig. 2*a* represents the male midge enormously magnified; *b*, the head, and *c*, the peculiar clasping organs still further magnified; *d*, the joints of the antennæ; *e*. the claws; *f f*, forms of the scales which are distributed over the wings and body. Fig. 3*a*, represents the female midge similarly magnified; *b*, the head; *c*, the tip of the ovipositor; *d*, a portion of one of the antennæ. The small lines beside the figures give the natural size of the midge. Fig. 4*a*, represents the larva; *b*, the head withdrawn into the first segment. These figures are from drawings by the late Prof. C. V. Riley,

pumps and nozzles, and the latter are quite as important as the former. We have now several good pumps manufactured in Canada; but the best nozzles are the Vermorel and the MacGowan. The former is a modification of the Cyclone nozzle, invented by Prof. Riley and his staff, of the United States Division of Entomology; the principle of this nozzle is that the liquid is forced tangentially into a small chamber, so as to strike the other side of the chamber; it is then forced through a minute central orifice, which has the effect of breaking up the liquid into a very fine spray. Too much importance cannot be attached to the fact that the liquid must be broken up into as fine a spray as possible, so that a very small quantity of the liquid may be used, and that it may be carried all through the foliage and left as a fine dew on the whole surface. In this way sufficient of the poison is deposited to destroy the insect enemies; at the same time, little is used, and there is no injury to the foliage.

During the past summer, there has probably been considerably more spraying done than ever before. This is largely due, of course, to efforts that have been made to bring this excellent method of preventing loss to the notice of fruit growers at the proper season. In Ontario much attention was drawn to the subject last year by some experiments carried out by Mr. John Craig, Horticulturist to the Central Experimental Farm, in a few orchards of Western Ontario. These experiments were very much extended and vigorously prosecuted during the past summer by instruction of the Hon John Dryden, Minister of Agriculture, who recognizes fully the value of this work to the province. The operations were put into the efficient hands of Mr. A. H. Pettit, who visited a great number of stations throughout the province, giving instructions and superintending the spraying of the orchards at regular intervals. The full account of this useful work will be published by the Department; but I many mention that Mr. Pettit has informed me that, on the whole, they have been very satisfactory.

In view of all that has been done by the Government of the country to distribute accurate information as to the best way of preventing injury to fruits by insect and fungous enemies, it certainly is a disgrace to our Canadian fruit growers that apples and other fruits are exposed for sale in this country, and exported to foreign markets in the spotted and blemished condition that is frequently the case. It is disgraceful because it is unnecessary. The two enemies, which are the cause of the greater part of this injury, are the Black Spot, a fungous disease, and the Codling Moth, the larva of which is the well-known "apple worm" Satisfactory remedies for both of these have been found; the Bordeaux mixture for the former, and Paris green for the latter. The cost of spraying these washes over the trees is very little, compared with the great saving which is made in the quantity and quality of the fruit harvested. Although it is true that the number of different kinds of insects which may attack our crops is very large, the actual number of those which are likely to appear every year is comparatively small; of these by far the larger proportion have been already studied and remedies have been published in the official reports, which are available for all who ask for them.

Before closing I must refer to one more subject, namely, the Horn-fly of cattle, which, of late years, has done so much harm among our dairy herds, but about which, from knowing the details of its behaviour since it was introduced into America, entomologists were at once able to give encouragement to dairymen, that in a year or two the virulence of its attacks would be much diminished. This prediction, I am glad to say, has proved correct; while, two years ago, in this very district, the loss in milk supplied to cheese factories was stated to be nearly fifty per cent. of the whole supply, last year it was much less, and during the present season, as far as I can learn, it has been brought down to only five per cent. Next year and thereafter, I hope confidently, that the annoyance from this insect will be reduced so much as to require no more attention than is given to-day to the ordinary cattle fly (*Stomoxys calcitrans*, L.)

Now, Mr. Chairman, I maintain that all this saving, to which I have referred, has been brought about from the development of the *science* of entomology. Science is a terrible word in the eyes of some people; but, after all, it is merely an illustration of the affectation of the age; some people like to use long words where short ones would do as well or better, or to use Latin where plain English would do. Science is a Latin word

which means simply knowledge, and it has been given the special signification of exact knowledge, or the best knowledge. I presume this was what Prof. James meant when he explained to us that the new agriculture was simply an outcome of the necessity, now-a-days, for farmers to have the best possible knowledge and education upon all subjects affecting their calling. I feel sure that everyone here was pleased to hear his kind words about the different societies he referred to, and most particularly proud of what he said of the work of this Society. There is no doubt that special knowledge is now necessary for farmers to compete successfully in the struggle of life. I noticed a statement in the newspaper this morning which well illustrates this fact.

Prof. Henry, one of the best known teachers of agriculture, who is at the present time doing good work at the Wisconsin Agricultural College, obtained his position owing to his practical knowledge of all the details of farming. He has always held that the best men and the best knowledge were necessary for successful farming, and used it as an argument for farmers' sons to remain on their farms and study farming in earnest. There was a vacancy at one of the other agricultural colleges for an agriculturist, and, the story goes, that Prof. Henry was asked if he could send a suitable man to fill the post at $1,500 a year. His answer was that he regretted to say that he could not then find a man properly equipped with all the necessary knowledge of farming, but that if it had been a lawyer or a doctor that was required he could send a whole carload at $600 apiece!

Mr. Fletcher resumed his seat amid much applause, and was followed by the Rev. T. W. Fyles, of Quebec, who read the following paper:

HOW THE FOREST IN THE DISTRICT OF BEDFORD WAS SWEPT AWAY.

By Rev. Thomas W. Fyles, F.L.S., South Quebec.

The remarks contained in this paper apply to that hilly section of the Eastern Townships which lies between the Seigniories on the one hand and Lake Memphremagog on the other, more particularly to the counties of Missisquoi, Shefford and Brome. I have known the locality for more than thirty years, and, in the early part of that period, was intimate with many of the first settlers of the district. Originally this was one vast forest, broken here and there by lakes and beaver meadows. The prevailing trees were the pine (*Pinus strobus* Lin.), the hemlock (*Abies Canadensis* Michx), the spruce (*Abies nigra* Poir), the balsam (*Abies balsamea* Marshall), the cedar (*Thuja occidentalis* Lin.), the tamarack (*Larix Americana* Michx), the maple (*Acer saccharinum* Wang), the beech (*Fagus ferruginea* Ait), the elm (*Ulmus Americana* Willd), the basswood (*Tilia Americana* Lin), the white ash (*Fraxinus Americana* Lin), the brown ash (*Fraxinus sambucifolia* Lin.) the birch (*Betula papyracea* Ait), the butternut (*Juglans cinerea* Lin.), the red cherry (*Cerasus Pennsylvanica* Linn), and the black cherry (*Cerasus serotina* Ehrhart). Some spots were named from the nature of the growth which covered them, as Pine Mountain and Spruce Mountain, in Brome.

In early days the staple productions of the district were pot and pearl ashes; and the tree that was found to yield the greatest abundance of these was the elm, and as in those days the law was administered in Montreal, and was an expensive luxury, the early settlers, many of whom were squatters, were allowed to do in the forest very much that which was right in their own eyes. Accordingly regardless of *meum et tuum*, they cut down the elms wherever they could find them, and converted them into "black salts." Consequently the elms of the primeval forest were the first of its trees to disappear. The pines followed next in order. The quality of the timber and the ease with which it was worked brought the white pine into great request. Where there was water transit, as for instance, near Lakes Champlain and Memphremagog, the clearing off of the pine was rapid. And, throughout the district local requirements could be satisfied only with the choicest timber, and all that was not of the best was accounted "vile and

refuse," and was "utterly destroyed." The old court house at Cowansville and the old church at West Shefford, in the soundness and clean grain of the pine lumber employed in them, showed the fastidiousness of their builders' choice of materials.

In the meanwhile, in the struggle for existence, the forest at large was being beaten back; and as Sampson of old said of the Philistines, so the settler might have said of his hacked and dismembered foes, "Heaps upon heaps here they lie!" Blackened piles cumbered the land, to be burned at fitting season, and their remains dragged into new pyres, until, in the language of the people, they were "quite worn out."

The first clearings for actual settlement were made where hardwood timber abounded, for it was well known that hard-wood stumps rot out in seven or eight years, whereas the stumps of black timber endure for a lifetime. The trees that were utilized in the havoc were the white ash, the brown ash and the basswood, which were split into fence rails. Now and then a cherry or a bird's-eye maple found its way to the turner's, to be converted into furniture, but too often indiscriminate destruction made room for the corn field and the potato patch. Often when the maples were spared to form a sugar bush, carelessness and ill-usage insured speedy decay. I frequently saw trees tapped by the acre with slanting gashes a foot long and two or three inches deep, a proceeding which impaired the circulation of the sap, producing a diseased condition of the tree, which, as we shall presently see, was peculiarly inviting to the attacks of injurious insects. Those were the days when stately specimens of the basswood (the lumber of which would now be worth $20 per thousand) were felled and notched into sections, which were split off and roughly shaped into sap troughs, the larger portion of the wood being wasted in the process.

As the clearings were enlarged and the dairy afforded more employment and greater profits, the traffic in "black salts" died out, and a second period in the history of the district may be said to have been reached. A third and striking era was opened when, by the enterprise of the late Hon. A. B. Foster, the railway to Waterloo was completed. Not only did farm produce meet with a readier sale, but a demand for hemlock bark, to supply the southern markets, arose, and men turned their attention more closely to the black timber. The short interval between the hoeing season and hay-time was diligently turned to account in peeling bark—the stripped hemlocks being allowed to lie as they had fallen. In consequence tangled slashes often disfigured the uplands, until a second growth—usually of poplar—hid their deformities.

Hitherto we have considered man's work in stripping the land of its bosky covering, but the elements played no unimportant part towards the same end. Fierce winds from the low-lying "French country," compressed in the valleys and defiles, again and again rushed up the mountain sides, and wherever they found a break formed by new settlements, impinged upon the exposed edges of the forest, and tumbled many goodly trees over, as if some huge monster were rooting amongst them. I know one spot where, for some acres, the trees, after a hurricane, lay in swaths, like grain from the scythe of the mower.

But, if the wind slew its thousands, fire may be said to have slain its ten thousands. The heedless and untimely burning of a brush heap often started a conflagration which extended for miles. One of the first inhabitants of Iron Hill told me that the grandest sight he ever saw was the fire rushing up through the pine woods on the western slope of Brome mountain. In May, 1877, I rode with the late Sheriff Cowan from Cowansville to Philipsburg, and men were pulling down fences and "fighting fire" all along the way. And at Philisburg clouds of smoke, sweeping across Missisquoi bay, told that the fire was raging in the State of New York. Great damage was done to the second growth sugar woods by this conflagration, and for several years after maple wood was *a bon marche.*

In addition to man and the elements, an innumerable yet unobtrusive army of sappers and miners worked upon the forest trees—grubs of beetles and horntails, and caterpillars of moths. I shall speak of but a few kinds that attacked (1) the "black timber," [illegible] woods, (3) the poplars.

(1) I remember standing in the chancel of a new church which I had built in the township of Brome in 1864, and hearing from the floor a slight rasping sound, I watched attentively, and presently the jaws and head of a Buprestis larva (Fig 5*a* and *c*, the larva and head; *b* pupa, *d* beetle), appeared through a hole. I looked around me and saw that there was a row of holes wherever the flooring rested upon a sleeper, and I found that the sleepers had been made of small spruce and hemlock trees hewn a little on the upper side. These trees were the habitations of Buprestidæ, the larvæ of which, having at this time attained their full growth, had gnawed their way through an inch of floor-lining, and an inch and a quarter of spruce boarding to the upper air, that they might enter upon the pupal condition satisfied that a way of exit had been secured for the coming imagoes.

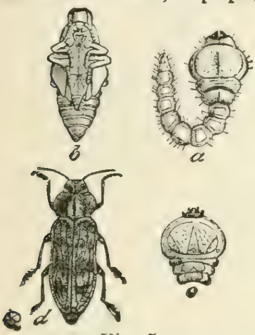


Fig. 5.

There is an insect, a longicorn beetle which, like the "Timberman" of Scotland, finds its food and habitation in the pine. It is *Monohammus Confusor* Kirby (Fig. 6). It is a dark gray, square-hipped insect, an inch and a quarter long, with antennæ of twice that length. This creature often presents itself unexpectedly in strange quarters. One afternoon I was sitting in my study in the rectory at Cowansville, which was then a new building, when suddenly a strange object came down with a great clatter upon the book I was reading. It was *M. confusor*. "Where did you come from?" I said. I looked round and soon discovered a hole recently made in the casing of the door. What an experience that insect had gone through! It had sprung from an egg laid in a crevice of a standing pine. The tree into which it had eaten its way had been cut down, hauled about in the woods, soaked in the mill-pond, and cut up by the circular saw. The boards had been banged about in the piling, had been kiln-dried, and then passed through a planing-machine. That particular board in which the beetle had had its habitation had been worked by hand in "the sash and door factory;" had been planed and fitted, and hammered and painted; and yet—surviving all the rough usage, and escaping all the deadly weapons—there had lain *M. confusor* snugly ensconced in his square-inch, or so, of wood, reserving himself until he could present himself as a gentleman. (Fig. 6.)


Fig. 6.

Another beetle closely related to *M. confusor*, and of similar habits is *Monohammus marmorator* Kirby. It is somewhat smaller than *M. confusor*, and has shorter antennæ. In color it is brown, marbled with pale yellow.

A third insect belonging to the same genus is *Monohammus scutellatus* Say, (Fig. 7). It is called by the French-Canadians, "*Le Forgeron*"—the Blacksmith. It is deep bistre in hue, and has a white scutellum. During the past season (1895) this insect has been unusually numous and destructive. In the spring one of my neighbors planted an extensive hedge of spruce around his grounds. By the end of summer nearly every scion had been girdled or partially so by the *Forgeron*. The larvæ of the species are even more destructive than the perfect beetles. I have seen a fine, large, spruce tree snap off, two feet from the ground, under pressure from the wind, and, on examination, have found that the stem was tunnelled through and through—scores of the Scutellatus larvæ having mined and countermined it in all directions.


Fig. 7.

(2) The hardwood also affords food and lodging to various insects. The handsome beetle, *Glycobius speciosus* Say (Fig. 8) (whose black and yellow livery is so suggestive of hornets and stings, but is *speciosus* notwithstanding) is frequently found in our wood-sheds, having arrived at perfection in the maple, the best of our fire-wood.

Fig. 8.

But there is a creature that far more extensively assists or accompanies the decay of the hardwood trees. It is one of the Horn-tails, *Tremex columba* Linnæus—an insect belonging to the order hymenoptera. The female *Tremex* is provided with a strong, black, bristle like ovipositor, which proceeds from the centre of the abdomen, and, when not in use lies extended beneath and beyond that section in a fixed and protecting sheath. In depositing its eggs the creature withdraws the ovipositor from its sheath raises its body and drives the appendage through the bark and into the soft wood, laying its eggs therein. As soon as the young grubs are hatched they begin to tunnel the wood; enlarging the bore as they increase in size. By the end of the first season they attain the dimensions of thread worms. The full grown larva is an inch and a half in length and has a waxen appearance. Its mandibles have a ferruginous tinge and its spiracles are light brown. The prop-legs are imperfect and the body terminates in a short spine.

Long observation has led me to believe that the Horn tails and other borers do not attack *sound and healthy trees*. I stated this belief in a lecture I gave in the Somerville course some years ago. Since then I have read the Rev J. G. Wood's "Insects at Home," and I am glad to find that some remarks of his bear out my statement. Speaking of the dreaded *Scolytus destructor* Olivier of Europe he says :—

"It is much doubted whether the Scolytus ever attacks a healthy tree, principally, as is conjectured because in such trees the burrows of the insects are filled with sap which not only drives out the beetles but prevents their eggs from being hatched. Still when a tree becomes unhealthy the attacks of the Scolytus prevent it from recovering itself," etc.

A tree struck by lightning, or broken by the wind, or scorched by fire, or hacked and abused by man is the chosen object of insect spoilers.

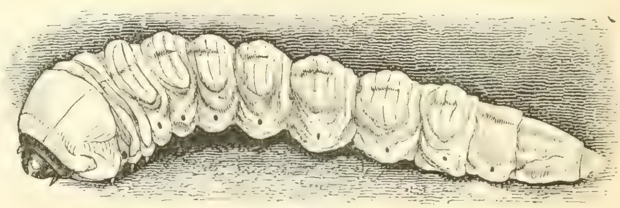


Fig. 10.

Fig. 9.

I have spoken of the waste of hemlock which followed upon the first demands for tanbark. Felled hemlock trees that are not soon sent to the sawyer's, are sure to be confiscated by a sawyer of another kind, *Prionus unicolor*, as Harris calls it—the one-coloured sawyer—the *Orthosoma brunneum* of Forster. (Fig. 9.) For nature not only abhors a vacuum ; she also abhors waste. A standing hemlock in the last stage of its existence

produces the *Boletus igniarius* which nourishes the Toad Beetle, *Boletophagus corticola*, Say. A fallen hemlock becomes the food of the Prionus grubs. (Fig. 10.) The creatures are well known to every farmer who has had to clear his land of the half rotten trophies of his early triumphs over the wilderness.

It yet remains for me to say a few words (3) concerning a borer which attacks the poplars, the latest growth on neglected brush lands. The insect is *Cossus centerensis*, Lintner. It belongs to the order lepidoptera. The perfect insect is a large moth with crape-like wings, dark grey in colour, reticulated with fine black lines. It makes its appearance in July. The male is smaller than the female. The presence of the larva is betrayed by the *frass*, or half digested sawdust, which it throws out, in early summer, from its burrow in the tree. On attaining its full size, the caterpillar retires some inches into the tree, and assumes its chrysalis condition. In due time, the chrysalis, by means of a series of serrated rings on its body, works it way along the tunnel bored by the larva, to the surface of the tree, and forces itself through, so as to clear its wing cases. The skin then bursts, and the perfect insect makes its escape.

In bringing this brief history to a conclusion I would bear in mind that the aim of all historians should be to convert the mistakes of the past into lessons for the future; and I would offer a few practical hints :—

I. Believing in the powers of the press, I would commend to all newspaper editors the practice of devoting a column to the discussion of rural affairs. Under a judicious editor the practice is invaluable, for many men in country places read the newspaper, and read little else.

II. In all normal and training schools, teachers should be led to see the importance of training the young in habits of prudence, forethought and economy For want of the exercise of such qualities in his early days many a farmer has now to buy his firewood, or to obtain it from a distance at the expense of much time and labour.

III. I would recommend farmers to thin out their sugar woods, plantations and copses, so that the trees may have ample room to spread their roots and obtain a firm hold on the earth, that they may not easily be overturned by a tempest.

IV. I should say, do not over-prune, and prune in the winter when the sap has ceased to work. Cover all wounds with grafting wax or oil-paint. Neglect of these precautions will throw the trees into a condition which will assuredly invite the attacks of destructive insects.

Lastly, I should say, tap your maple trees with care; use a duck-bill augur and cedar spouts, which "give" and do not split the bark.

A cordial vote of thanks to the Mayor, for his kindness in presiding on the occasion and allowing the use of the city hall for the meeting, was proposed by Mr. Dearness, who spoke very happily of the pleasure and instruction which they had all received from the addresses of the evening, and was seconded by Mr. Saunders, and adopted by the meeting with much applause.

Mr. E. R. Cameron then moved, seconded by Mr. S. H. Craig, a vote of thanks to the speakers who had come from a distance to address them, and had afforded them so much gratification. After putting the motion, the meeting was closed with a few pleasant remarks from the Mayor, who wished the Entomological Society of Ontario a long continued and prosperous career.

THURSDAY, NOVEMBER 28th.—MORNING SESSION.

The meeting was called to order at 10 o'clock, a.m., the chair being taken by Mr. Fletcher. The reports of the various sections of the Society were presented and read by their respective secretaries.

REPORT OF THE BOTANICAL SECTION.

The Botanical Section beg to submit the following report for the summer of 1895:

Regular weekly meetings of the section were held from April 22nd to October 19th. The average attendance was considerably in advance of that of the previous year. A number of the public school teachers of the city joined the Society, and became industrious workers in our section. For the benefit of those just beginning the study of botany, a part of each meeting was devoted to the study of some important natural order, illustrated by typical specimens collected by the members.

Papers upon the following subjects were read at different meetings:

1. "The Humanity or Civilization of Plants and Flowers," Prof. J. H. Bowman.

2. "The Relation of Chlorophyll to the Forms of Plants," W. T. McClement.

3. "The Distribution of Plants in Ontario, with Special Reference to the London District," Mr. J. A. Balkwill.

4. "The Dissemination of Seeds," W. T. McClement.

One public field day was held, July 1st, when the members and their friends visited Komoka, and made large and beautiful collections, the feature of the day being the abundance of *Cypripedium spectabile.*

During the season the following plants were added to the local list:

Spergula arvensis—Mr. J. A. Balkwill.

Arctostaphylos Uva-ursi—Prof. J. Dearness.

The section have deemed it wise to direct their attention to the arrangement of a Flora of Middlesex county. A good start has been made toward this, as we have the list of *Polypetalous* and *Gamopetalous Exogens* ready for final revision. We have to thank Mr. Fletcher for a number of rare and interesting plants from the Ottawa district, which he donated to the Herbarium.

W. T. McClement, Secretary.

Mr. Fletcher spoke of the value of the proposed Flora of the County of Middlesex. He also stated that *Spergula arvensis*, which had recently been found in the neighborhood of London, was recommended by the Michigan State Agricultural College for introduction as a fodder plant, but in Europe it was regarded as a persistent and troublesome weed, and was found to bear the same character in some parts of Canada. He strongly deprecated its introduction by farmers into this country.

REPORT OF THE GEOLOGICAL SECTION OF THE ENTOMOLOGICAL SOCIETY FOR THE YEAR 1894-95.

We have much pleasure in reporting to your honorable body that the Geological Section has had a most prosperous year. Our membership has increased; the average attendance at our meetings has been greater than during any previous year.

Many valuable additions have been made to our private collections since last we reported progress, but we are still looking forward to the formation of a central collection in our city, to which the members of our Society and all our citizens may have free access.

The section would suggest that it would be a great advantage to students of mineralogy if some steps could be taken by which the small number of Geological and Natural History societies in the Province could be provided with small collections of accurately named specimens of the chief economic minerals.

The members of our section have made trips to a number of places of geological interest, including Rockwood, Elora, Guelph, North Dorchester, and the mammoth and colossal Caves of Kentucky.

Valuable papers have been read before our section, showing the methods of gold mining in Australia, Colorado, Ecquador and Madoc.

Addresses on the following subjects have been made by various members of our Society:

1. "Trip to St. Joseph's Island." By Mr. MORRIS.
2. "Australian Gold Fields," Mr. WEBB.
3. "Crystallography," Dr. WILSON.
4. "Canoe Cruise on Lake Nipissing," Mr. ALLISON.
5. "Physical Basis of Knowledge," Mr. SCARROW.
6. "Correlation of Forces," Mr. B. GREEN.
7. "Trip to Mammoth Cave," Dr. WOLVERTON.

Signed on behalf of the Geological Section by

G. F. SHERWOOD, Secretary. S. WOOLVERTON, Chairman.

REPORT OF THE MICROSCOPICAL SECTION OF THE ENTOMOLOGICAL SOCIETY.

The season opened with the first meeting on October 12th, and continued every second week till March 29th, at which time, as is usual, we discontinued in favour of the Botanical Section, of which nearly all the microscopists are active members.

Regular Meetings.—There have been twelve such. Interest has been well sustained throughout the season, meetings regular, attendance good, subjects excellent and well presented. More than usual the members have engaged in practical work. Among the subjects were: "The Study, Dissection and Mounting of Earthworms," led by Dr. Hotson; "Fungi" (Hymenomycetes), and "Wood Sectioning, Staining and Mounting," led by Prof. Dearness; "Insect Mounting Without Pressure," also "Cell Building," by Mr. Rennie; "Brownian Movement," led by Mr. W. T. McClement; "Fluid Mounting of Green Algæ," also "Collection and Mounting of Diatoms," led by Jas. H. Bowman. Very many microscopical plants were brought in by members and furnished many an enjoyable hour.

Open Meetings.—Of these, two were held, and, as usual, attracted a large attendance and were well appreciated by those for whom they were intended. In this connection we would say that we find our present quarters very ill-suited for this class of meeting. Had we held the same in some more convenient place, no doubt a great and favorable difference would be observed.

Outings.—These are not so frequent as they might, and would be, if it were not that we occupy only winter months. We have, however, the benefit of the botanists' excursions in the summer time as our members who are botanists are always thinking of our section and preserve their finds and work up their subject in connection with them for our meeting season.

JAS. H. BOWMAN,
Secretary of Section.

REPORT FROM THE ENTOMOLOGICAL SOCIETY OF ONTARIO TO THE ROYAL SOCIETY OF CANADA.

By the Rev. Thomas W. Fyles, F.L.S., Delegate.

I beg to state respectfully that the Society I have the honour to serve on this important occasion, is in a healthy and growing condition—sound financially, possessing a large amount of *materiel*, and held in estimation at home and abroad.

It is to be expected that the subject of economic entomology will commend itself more and more amongst the intelligent members of a fruit growing and agricultural community. The insect enemies of the farmer and gardener are numerous and persevering, and accomplish incalculable harm; and a society that studies the life histories of these foes, and searches for checks upon their efforts, can hardly fail to win adherents and to command support. Accordingly we find that at the thirty-second annual meeting of our Society the council was able to congratulate the members upon "the steady increase in numbers which continued to take place, and the hearty interest that was maintained in the various departments of the Society's work."

The headquarters of the association are in London, the chief town of one of the mo important agricultural and horticultural sections of Ontario, and a fitting centre for a society which is aided by the Ontario Government, and is intended to promulgate practical information amongst the cultivators of the soil, as well as to foster scientific research. The Government grant made to the Society annually is $1,000.

That the Society is doing the work expected from it, and doing it well, may be shewn on sufficient testimony. Thus Mr. L O. Howard, Chief Entomologist of the Department of Agriculture, Washington, says of it: "The Society has conscientiously complied with the conditions of the grant. Its reports published annually have greatly increased in size, and in the general interest of their contents. They have contained much matter of economic value as well as of educational interest" And the editor of an English magazine speaks of the report last issued as one of more interest to him than all others received from America. Doubtless the Society, with a larger grant, could accomplish more good.

The annual meeting, to which I have referred, was held on the seventh and eighth days of November last. The value of the addresses and of the papers read, and the beauty and rarity of the specimens exhibited on this occasion were fully appreciated by those who were privileged to attend. The President's address was particularly valuable as an instructive sketch, *historical* and *geographical*, of the Society and its work. It was learnt from it that the society has observers and correspondents from east to west throughout this vast Dominion—from St. John, N. B, and Halifax, N. S., to Esquimalt in British Columbia and Masset in Queen Charlotte Islands. A very valuable paper on "The Rhopolocera of the Eastern Provinces of Canada," was read on this occasion by the Rev. Dr. Bethune, editor of the *Canadian Entomologist* It gave a complete list of species and the names of the localities in which each local kind has been taken with—as far as is known—the food plants of the different species.

The titles of the other papers read at the meeting are as follows:—

"Insects Collected in Bermuda During the Winter of 1894," by Gamble Geddes, Toronto.

"Common Names for Butterflies—Shall We Have Them?" by H. H. Lyman, Montreal.

"The Pitcher-Plant Moth," by James Fletcher, Ottawa.

"Catastega aceriella *Clemens*, Semasia signatana *Clemens*," by the Rev. Thomas W. Fyles, South Quebec.

"Notes on a Few Canadian Coleoptera," by W. Hague Harrington, F.R.S.C., Ottawa.

"Food, Feeders, and Fed," by Rev. Thomas W. Fyles, F.L.S., South Quebec.

"An Attack of Ephestia interpunctella," by H. A. Stevenson, London.

"The Economic Value of Parasitism," by F. M. Webster.

"The Re appearance of Pieris Protodice *Boisd.*," by J. Alston Moffat, London, Ont.

"Remarks on the Structure of the Undeveloped Wings of the Saturniidæ," by J. Alston Moffat.

"Bordeaux Mixture as a Deterrent Against the Flea Beetles," by L. R. Jones, Burlington, Vermont.

"The Gypsy Moth," by James Fletcher, Ottawa.

'The San Jose Scale," by James Fletcher, Ottawa.

"Injurious Fruit Insects of the Year 1894," by James Fletcher, Ottawa.

The twenty-fifth annual report, issued by the Society, contains portraits of Professor William Saunders, F.R S.C , President of the Society from 1875 to 1886, and Augustus Radcliffe Grote, A.M., one of the Society's honorary members, and it is also illustrated with sixty figures of insects.

Besides the President's address and the papers above-mentioned, the report contains .—

The minutes of the meeting.

The Report of the Librarian and Curator, Mr. J. Alston Moffat.

The Report of the Montreal Branch, presented by Mr. H. H. Lyman, President, and signed by Mr. A. F. Winn, Secretary.

The Report of the Geological Section, presented by Dr. S. Woolverton, Vice-Chairman.

The Report of the Botanical Section, presented by Mr. W. F. McClement, Secretary.

The Report of the Delegate to the Royal Society of Canada.

A very valuable abstract of the proceedings of the sixth annual meeting of the Association of Economic Entomologists, supplied by Mr. L. O. Howard, Entomologist of the Department of Agriculture, Washington, and Mr. C. L Marlatt, Secretary of the meeting; and a number of interesting notices, critical, biographical, etc.

This report is distributed "not only to our own members, but to every member of the Fruit Growers' Association, to members of Parliament, the Mechanics' Institutes, etc., making an issue of 6,000 copies, (W. H. Harrington, *Canadian Entomologist*, vol. XXVI., p. 2.)

The Society's library now numbers 1,361 volumes—seventy-seven having been added in the course of the year.

Important additions have been made to the Society's collections of insects. In its cabinets may now be seen representatives of 1,077 species duly classified and named.

The Society is fortunate in retaining the services of Mr. J. Alston Moffat as Librarian and Curator. By his methodical habits, his manual skill in mounting specimens, and his extensive knowledge of the lepidoptera, Mr. Moffat is peculiarly fitted for the position he holds.

During the year the various sections of the Society have held field days at St. Mary's, Dorchester, Kilworth, Byron, Komoka, Kettle Point (Lake Huron), Ilderton, Thedford, Beechville, Woodstock, Mud Lake and other places. The value from an educational point of view of such expeditions in a neighborhood that possesses such experienced scientific guides and instructors as Messrs. W. E. Saunders, J. M. Denton, J. A. Balkwill, J. W. Dearness, J. H, Bowman, Dr. S. Wolverton, R. W. Rennie, all long connected with the Society, besides younger and enthusiastic men, is beyond estimation.

The *Canadian Entomologist* has reached its twenty-seventh year. The volume for 1894 contains articles from sixty-one contributors—fourteen residing in Canada, forty in the United States, five in England, one in Germany and one in Sweden. In its pages are described no less than seven new genera and ninety-five new species of insects. The magazine continues under the able management of the Rev. C. J. S. Bethune, D.C.L., F.R.S.C., etc.; and it is a striking proof of the courage and perseverance of its editor that notwithstanding the cares and anxieties that must have thronged him, through the destruction by fire of his noble school buildings and the beautiful chapel attached to them, the *Canadian Entomologist* has made its appearance as regularly as ever and as carefully edited.

Hitherto the Entomological Society of Ontario has studied the life-histories of insects, the methods of attack of the pests of the homestead, the storehouse, the garden, the orchard, the field and the forest; the ways for circumventing these foes; and the nature and application of insecticides. Much, no doubt, remains to be learned on all these subjects. But the attention of naturalists has of late been drawn to a new and most important matter. It is, to use the heading of one of the papers published in the Society's report that has been mentioned, *The Economic Value of Parasitism.* It is well to know how to meet enemies ourselves, but it is better sometimes to know how to direct faithful allies against them. If the parasite (*Diplosis grassator* Fyles), which keeps down the numbers of the Philloxera in this country, had been carried over to Europe, it would doubtless have saved many a vineyard that has disappeared. The introduction of the Australian Lady-bird (*Vedalia cardinalis* Mulsant), the foe of the "Fluted Scale," has probably saved the orange groves of California from extinction. The predaceous beetle (*Clerus formicarius* Linnæus) has lately been introduced into Western Virginia by Professor Hopkins, as a check upon the "Borers" that have wrought such destruction in the spruce forests of that country, And this bringing about of good by the directing of insect agents is only in its beginning. As our knowledge increases we shall in all probability be able to gather and control forces that at present are but little understood.

Election of Officers.

The following gentlemen were elected officers for the ensuing year:

President—J. W. Dearness, London.

Vice-President—H. H. Lyman, Montreal.

Secretary—W. E. Saunders, London.

Treasurer—J. A. Balkwill, London.

Directors—Division 1. James Fletcher, F.L.S., F.R.S.C., Ottawa.
" 2. Rev. C. J. S. Bethune, F.R.S.C., Port Hope.
" 3. Gamble Geddes, Toronto.
" 4. A. H. Kilman, Ridgeway.
" 5. R. W. Rennie, London.

Librarian and Curator—J. Alston Moffat, London.

Editor of the "Canadian Entomologist"—Rev. C. J. S. Bethune, M.A., D.C.L., Port Hope.

Editing Committee—J. Fletcher, Ottawa; H. H. Lyman, Montreal; Rev. T. W. Fyles, South Quebec; J. M. Denton, London.

Delegate to the Royal Society—J. D. Evans, Trenton.

Committee on Field Days—Dr. Woolverton, Messrs. Sherwood, McClement, Balkwill, W. Stevenson, W. E. Saunders, Anderson, Elliott, Rennie, and Bowman, London.

Auditors—J. M. Denton and J. H. Bowman, London.

Field Days.

A discussion on Field Days and the best methods of conducting them was participated in by most of the members present. Mr. Fletcher described the plan adopted by the Field Naturalists' Club of Ottawa, which had proved very successful. It was decided that every effort should be made next summer to develope the system and that the annual meeting of the Society should, if possible, be held in August in order to have a general outing for the members in connection with it.

The Canadian Entomologist.

A discussion was next carried on by Messrs. Balkwill, Rennie, Dearness, and Fletcher as to the possibility of reducing the expense incurred in the publication of the *Canadian Entomologist.* The treasurer and editor were instructed to confer with the publishers on the subject. Mr. Dearness suggested that a leaflet should be printed for enclosure in correspondence, setting forth the advantages of membership in the Society.

AFTERNOON SESSION.

The meeting was called to order by the President, Mr. J. W. Dearness, at 3 o'clock, p.m.

Papers were presented by Mr. Moffat on "Observations on the Season of 1895," "Variation, with Special Reference to Insects," and "The Growth of the Wings of a Luna Moth."

Mr. Fletcher gave an interesting address on his trip to British Columbia during the past summer, which was undertaken for the purpose of collecting and observing insects and plants throughout the region traversed. He illustrated his remarks by exhibiting a beautiful collection of dried plants that he had made, and several boxes of rare and remarkable insects.

A fine specimen of the exceedingly rare elater, *Sarpedon scabrosus*, was exhibited by Mr. J. D. Evans, who had taken it during the past summer at Trenton, Ont.

The receipt of valuable donations to the Society's collection of insects was announced from the Rev. G. W. Taylor, Nanaimo, B.C., Mr. E. Firmstone Heath, the Hermitage, Cartwright, Manitoba, and C. de Blois Green, Osoyoos, B.C., and the hearty thanks of the Society were accorded to the donors. Dr. Bethune stated that arrangements had been made for the exchange of publications from the year 1868 with the Entomological Society of France, whose "Annals" would form a very important and valuable addition to the library.

Much time was very enjoyably spent by the members during both the days of meeting in exhibiting rare captures, examining the cabinets and books of the Society, and comparing notes on many interesting entomological subjects.

INSECT INJURIES OF THE YEAR 1895.

By James Fletcher, Ottawa.

The insect injuries to the crops of the province during the past season have been almost entirely by well-known pests.

Cereals.—Grain crops have suffered very little; the most serious injuries were by "grasshoppers." These developed in large numbers all through those districts where

drought prevailed, and did much harm to grass, oats and barley. The species which were most abundant were *Melanoplus femur-rubrum*, *M. atlanis* and *M. bivittatus*. Cutworms (Fig. 11) were less complained of than usual, taking the province as a whole. *Hadena arctica* and *Hadena devastatrix* occurred abundantly in the extreme western counties. Hessian fly was sent in from the Muskoka district; and also the joint worm (*Isosoma hordei*), Fig. 12, the latter attacking wheat and injuring it to the extent of five per cent. at Meaford, Ont.

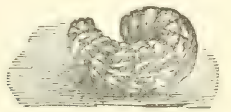


Fig. 11.

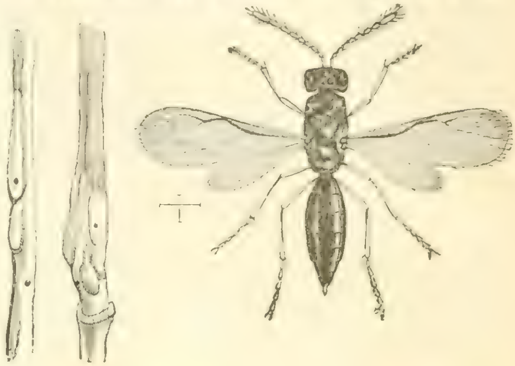


Fig. 12.

Fodder Plants.—Under this head, undoubtedly the greatest damage was done by grasshoppers, and farmers will do well next season to examine their grass lands early in the season before the grass is too high, to see if there are many of the young, and if so, to use one of the different "hopper-dozers" or oil pans which are used to such good effect in the Western States. The Pea Moth has continued its injuries, and up to the present no practical remedy has been discovered. I commend this insect to the particular attention of our members. Although known as so abundant and injurious for the past twenty years, the perfect insect in this country has never yet been identified.

Roots.—The Colorado Potato-beetle still exists in great numbers, but with so cheap and effective a remedy as Paris green, it cannot be considered a serious enemy except by the lazy or careless. The larva of *Gortyna cataphracta* was sent in from three or four places in Eastern Ontario as having bored into the stalks of potatoes, tomatoes and many other garden plants. A new attack on potatoes reported this year for the first time was by *Otiorhynchus ovatus*, which was sent from Fenella, Ont., by Mr. J. B. Brook, who had found it girdling the stems of his potatoes. The same insect was found injuring young apples, pears and currants at Arthabaskaville, Que. Turnips were badly attacked all over the province by the Turnip Aphis, and many reports were received. There is no very satisfactory remedy for this insect. Careful watch should be kept in August when hoeing and thinning turnips. At that time the colonies are small and few in number, and if care be taken to destroy them then, much may be done to control the outbreak. Spraying with kerosene emulsion was found to be useful when the colonies were not too numerous. A tobacco and soap wash would be equally effective. The Diamond-back Moth (*Plutella cruciferarum*) was also abundant both on turnips and cabbages, but affected the crop very little. Cabbage and Onion Root-maggots were as usual abundant in many places, and did much harm. The Imported White Cabbage Butterfly (*Pieris rapæ*), Fig. 13, is not now considered a very serious enemy where the use of pyrethrum powder and flour (one to four) is practised. The best way to apply the remedy is to dust it over the cabbages as soon as the work of the larvæ is noticed, by means of small hand bellows or from a muslin bag. It cannot be too strongiy insisted upon that Paris green must never be used on cabbages.

Fig. 13.

Fruits.—The injuries to fruits cannot be said, as compared with other years, to have been very serious. Most of the usual pests have put in an appearance and done some harm, but the more general adoption of the excellent practice of spraying regularly is having a noticeable

effect. Codling moth, Plum curculio, Canker-worm, Eye-spotted Bud-moth, Tent caterpillars and Fall Web-worm have been abundant in some places, but their numbers have been brought down considerably wherever spraying with the arsenites was resorted to.

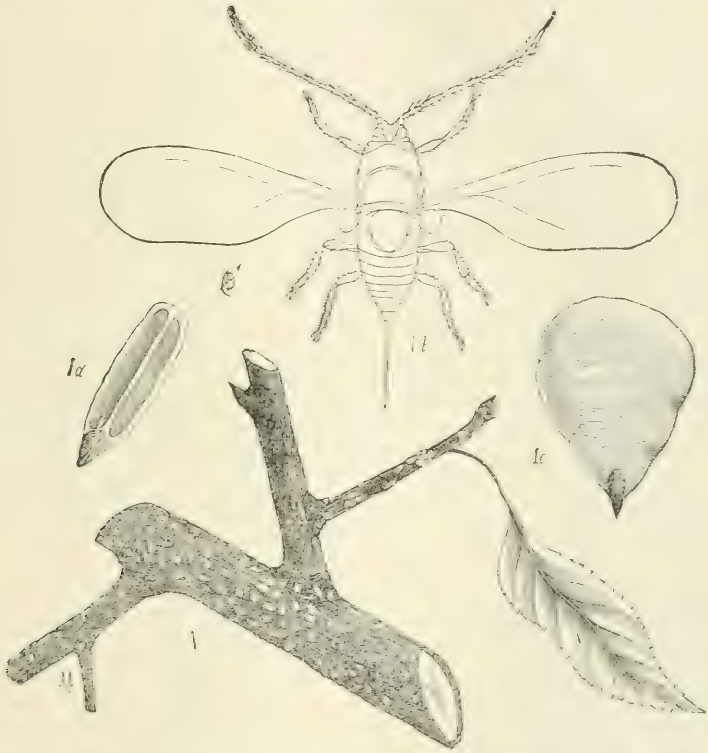


Fig. 14.—1, twig with scales; 1*a*, scale of male; 1*b*, winged male; 1*c*, scale of female—highly magnified.

The Oyster-Shell Bark-louse is abundant throughout the province, and where orchards are neglected does much harm. Spraying with kerosene emulsion when the young insects emerge from the old scales, about 1st June, is the best remedy. The Scurfy Bark-louse, *Chionaspis furfurus*, Fig. 14, was sent from Essex County. One tree was badly infested, but a thorough spraying with kerosene emulsion entirely cleaned it.

The New York Plum-scale (*Lecanium*) has been found, on enquiry, to be present to some extent all through the Niagara peninsula and in some other western counties. Only two bad occurrences have been discovered, and I am much pleased to be able to report that these have both been eradicated by treatment with kerosene emulsion. The life-history of this scale is quite different from that of the Oyster-Shell Bark-louse. In this species, the young emerge at the end of June and make their way out on to the foliage, where they remain without growing much until autumn; they then crawl back again on to the twigs and branches and hibernate there. When revived by the return of spring, they move again and fix themselves to the young wood, chiefly on the lower side of the smaller branches. They grow very rapidly in spring, and the tiny flat scales which hibernated, soon become large, conspicuous, dark brown, hemispherical scales, varying somewhat in size, but about one-eighth to one-sixth of an inch in length by about half of that length in height. The basal outline is ovate or almost round, being very nearly as wide as long. This insect has been carefully studied by Mr. Slingerland of Cornell University, and the remedy which he suggested has been used very satisfactorily both at Queenston and Grimsby, where the two serious outbreaks referred to above occurred.

This treatment is to spray infested trees at least twice during the winter with a strong kerosene emulsion wash—the Riley-Hubbard emulsion diluted with only four parts of water. This did no harm to the plum trees, but quite destroyed the scales.

Canker-worms (*Anisopteryx*). There has been a good deal of enquiry during the past season as to the best way to treat Canker-worms in orchards There can be no doubt about the superiority of spraying with Paris-green over all other methods, where the trees are small enough to be reached easily with an ordinary spraying nozzle; but where trees are old and large, some growers still prefer to use the old method of banding the trunks of the trees with printers' ink and oil or some other viscid material. Mr. O. T. Springer, of Burlington, Ont., uses a mixture consisting of castor oil, two pounds and resin, three pounds, heated and thoroughly mixed. This is painted directly on the tree trunks in autumn and spring. In Nova Scotia, printers' ink is reduced with fish oil, and this is painted on strips of thick paper which have been previously tacked round the trunks. Mr. E. J. Armstrong, of Church Street, Cornwallis, in the Annapolis valley, informed me, when enquiring why he preferred banding to spraying, that the chief reasons were that the trees in Nova Scotia were large, and it was the practice to grow other crops in the orchards, and, besides, injury had been done by careless spraying. He gives the cost of this treatment about as follows: Printers' ink is about twelve cents a pound; twenty pounds of ink will require four gallons of fish oil, at fifty cents a gallon. This amount will answer for an orchard of five acres, the trees being of about twenty or thirty years. It will require about fifteen pounds of paper, at four cents a pound. This is cut with a saw from the roll in strips six inches in width. Two men, armed with a sharp knife and a tack hammer, can go over an orchard of five acres in half a day, the first man measuring the tree and cutting off sufficient paper to band it, the second one tacking it on. The ink is applied in autumn and spring with a paint brush, and the paper put on in autumn is ready for the next spring.

The Cigar Case-bearer (*Coleophora Fletcherella*), which has done so much harm to apples in Ontario and Nova Scotia during the past four or five years, and of which I spoke last year, has been the cause of much loss again this year. Spraying with kerosene emulsion, directly the young caterpillars begin to move out on to the buds in spring and spraying regularly two or three times at short intervals of four or five days with Paris green, one pound to 200 gallons, have both been attended with a measure of success; but this is an exceedingly difficult insect to destroy, owing to the fact that the caterpillar feeds mostly on the inside tissues of the leaf, merely eating a small hole through the outside skin so as to get at the inner tissues, which it mines out in a large blotch mine as far as it can extend its body from its case. Mr. Edwin Worden, of Oshawa, has, during the past summer, sprayed his trees with a Paris green and lye wash, which he writes me has been most satisfactory. The first time he used this remedy he sprayed with concentrated lye only. This was about the middle of May, 1894, and Mr. Worden was under the impression that the application had not killed many of the Case-bearers; but the effect was very beneficial, and he could see distinctly where the spraying had been done by the cleanness of the trees from moss and Oyster-Shell Bark-louse. Last summer he sprayed again with three cans of concentrated lye and one quarter pound Paris green in forty-five gallons of water, and secured the best of results; he particularly states that the lye did not injure the foliage at all. This spraying was done in the beginning of June, and Mr. Worden's object was to destroy at the same time the Codling Moth, the Cigar Case-bearer and the Oyster-Shell Bark-louse. No doubt many other pests would be killed at the same time, such as the Canker-worm, Eye-spotted Bud-moth, Leaf Rollers, etc.

The Peach Bark-borer (*Phlœotribus liminaris*) which has for some years done so much harm in the peach orchards of the Niagara Peninsula, has this year been successfully treated by Mr. C. E. Fisher, of Queenston. Noticing that the perfect beetles became active very early in the spring, he washed his trees then with a strong alkaline wash to which carbolic acid had been added. He made his wash as follows: Five pounds of washing soda, three quarts of soft soap, and enough water to make six gallons. Air-slaked lime was then added sufficient to make it of the consistency of thick paint. To all this was added three tablespoonfuls of Paris green and one ounce of carbolic acid.

This mixture was applied with a whitewash brush, thoroughly covering the entire trunk of the tree and a few inches up on the limbs. Mr. Fisher reports that at the end of the season he is quite satisfied with the results of the treatment. It would appear from what I have just said that two applications of this mixture, the first one being made as soon as the beetles become active, sometimes as early as March, and another six weeks later, would provide us with an effective remedy for this little pest, which for some years has done considerable harm in our Canadian peach orchards.

Black Peach Aphis (*Aphis persicæ-niger*).—The only new fruit pest of any importance which has appeared in the province during the past season is the Black Peach Aphis, of which specimens have been sent in from two orchards at Leamington, in Essex county. The insect has undoubtedly been imported from the United States on young nursery stock. There are two forms of this insect, one attacking the twigs, the other, more injurious and much more difficult to treat, occurring on the roots. Prof. John B. Smith, of New Brunswick, N. J., who has studied this Aphis a great deal, states that the form on the twigs is easily controlled with kerosene emulsion; and the underground form he has successfully treated with heavy top dressings of kainit. He recommends for light soils in New Jersey about ten pounds per tree, covering the probable extent of the root system, This is for a bearing tree from four to six inches in diameter, and the time for applying the kainit is in the spring, when the trees are leafing out. Prof. Smith states that "the kainit has proved successful in our orchards, wherever used." Another method of treatment which has been recommended is to dig in tobacco waste around the roots.

Fig 15.

Fig. 16.

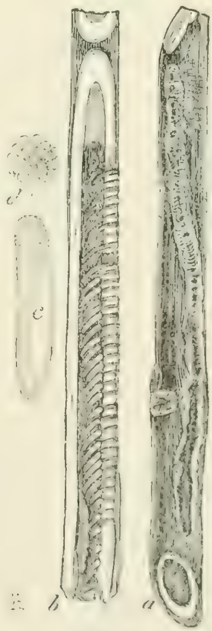


Fig. 17.

Fig. 15, male; 16, female; 17, injured canes.

Mr. Woolverton, the energetic Secretary of our sister society, the Fruit Growers' Association of Ontario, states that the Pear Leaf Blister Mite (*Phytoptus pyri*) is rapidly gaining ground in the Niagara district, the corky dark-colored galls being conspicuous on the foliage of most pear trees. On account of the diminutive size of the mite which causes these blister-like galls and from the fact that it works inside them out of sight, it is seldom recognized as the cause of the injury, many people attributing the origin of the galls to

some parasitic fungus. The treatment which has been recommended for this pest is spraying the trees with kerosene emulsion just as the buds burst in spring. On the Pacific Coast, where it is also very prevalent, good results have been obtained with a winter wash consisting of sulphur one pound, lime two pounds, salt one pound, and water three gallons. The manufacture of this wash is described in detail in an article on the San Jose Scale published in our last annual report.

The Snowy Tree-Cricket (*Œcanthus niveus*), or one of the allied species, is doing much harm in raspberry plantations about Hamilton. Several specimens of injured canes have been sent to me which had been pierced by the females when depositing their eggs. Some of these had split open down the whole length of the punctured area, and the canes in all cases were much weakened. This insect is claimed to be predaceous, and Miss Mary Murtfeldt, who I think was the first to observe this fact, says that they feed almost entirely upon Aphides and other minute pests and make ample compensation for all the injury that they do, and that they should be considered beneficial rather than injurious. Around Hamilton, however, I am told by Mr. Wm. McEvoy, of Woodburn, Ont., that the injuries to raspberry canes are serious. The only remedy which seems practicable is the pruning and burning of the injured canes early in spring before the eggs hatch, for the insect passes the winter in the egg state inside the canes. Figs. 15, 16 and 17.

The insects I have mentioned I think will include all the worst enemies which have been brought before my notice during the season as having occurred injuriously in the province. There were, of course, several others, but none requiring special mention, except, perhaps, the Carpet Beetle (*Anthrenus scrophulariæ*), Fig. 18, which is gradually extending its range, and the Mediterranean Flour Moth (*Ephestia Kühniella*), Fig. 19, for which a

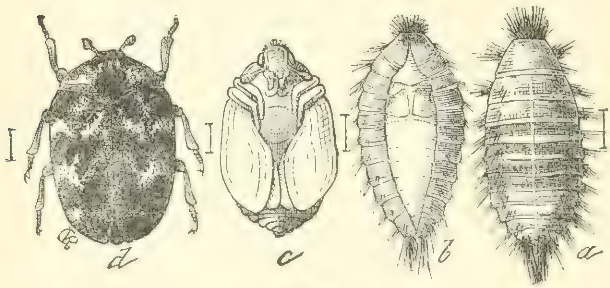


Fig. 18.

Fig. 18, *a* and *b*, larva ; *c*, pupa ; *d*, beetle.

Fig. 19.

(a). Moth (imago) magnified.
(b). Outline, showing natural size.

new locality has been found at Valleyfield, Que. Specimens were sent to me from a mill early in October, and instructions were promptly given as to the best steps to take to clean the mill. These were adopted, and in December I received a report from the manager that the outbreak had been suppressed. I think it probable that he may have taken too favourable a view of the matter, and I have urged upon him the necessity of keeping a constant watch for any appearance of the insect. This is not only an extremely injurious pest, but an exceedingly difficult one to eradicate. I find that it occurs more or less plentifully in some of our large milling centres, and, where special efforts are not put forth to control it, loss is sustained.

THE GROWTH OF THE WINGS OF A LUNA MOTH.

By J. A. Moffat, London, Ont.

In the afternoon of March 5th, 1895, I heard a noise amongst my cocoons. On examination I found that it proceeded from the cocoon of an *Actias Luna*, Fig. 20, which had been given to me early in the season. It was extremely thin ; when I took it up I could see the movements of the imago through it. It was revolving as well as scratching

vigorously. It seemed to be conscious of its imprisonment, and appeared so eager to escape, it made me feel uncomfortable, so I opened a hole in the cocoon, out of which it crawled on to a finger which I extended for its convenience, thus missing an opportunity of seeing it dig its own way out. It was perfectly dry, and left no moisture on the cocoon or pupa case. I gave it a position to suspend from, where I could observe it conveniently. I looked at the time; it was a quarter to three. It did not show the slightest inclination to travel.

Fig. 20.

The abdomen was fully extended, green in colour with, comparatively, narrow white bands around it. The front winglets were about three-quarters of an inch in length, the hind ones less, clothed with hair-like scales, slightly tinged with yellow, sufficient to contrast with the pure white of the body covering. The tail was bent round and laid along the outer angle of the hind winglet, as shown by part *b* on Fig. 21, which gives a moderately correct representation of it on an enlarged scale. At five minutes to three a green spot appeared near the base of front winglet, gradually enlarging as the fluid spread between the membranes, and deepening in colour as the quantity increased. At three o'clock the green had reached the eye spot on the front wing, and the maroon colour of the costal band. At 3.10 the wing was one inch and a half long. By this time the fluid was passing rapidly along the costal edge and extending, whilst the outer angle had not yet begun to extend; the result was the apex drawn back, the membrane of the wing bulged and bagged outward. At this time the hind wing had got a green tinge along the outer margin, which was extending. At 3.20 the outer angle of front wing had relaxed somewhat, which allowed the costa to straighten and reduced the bulging. 3.35—the front wing looked to be full length, but not full width. 3.45—hind wing well expanded and green coloured; part *b* on Fig. 21 had moved away slightly from part *a*.

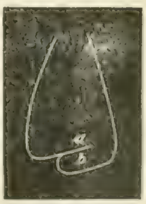


Fig. 21.

At four o'clock the space between *a* and *b* was nearly half an inch, but *b* yet retained its horizontal attitude. At 4.10 the space between them had increased, and the point of part *b* was drooping. 4.45—the tail had greatly extended, hanging crumpled and twisted. At 5.10 the moth opened its wings and walked away when I ceased taking observations. I allowed it to live over night. It was a female, not a first-class specimen. It measures four and a half inches in expanse of wing, and three and a quarter from the base of the antennæ to the end of the tail. It is heavily edged with maroon on the outer angle of front wing, and more lightly on the hind wing and outer curve of the tail. There is a row of brown dots on the veins of front wings, three-eighths of an inch from the coloured edge, which are not seen on any other native specimen in the collection. As it matured the abdomen contracted until the white bands united, and the green disappeared.

OBSERVATIONS ON THE SEASON OF 1895.

By J. Alston Moffat, London, Ont.

Hadena Arctica, Fig. 22, one of the climbing cut worms, the moth of which is seen to some extent every season, and in some seasons quite plentifully, appeared in the early part of June in extraordinary profusion, forcing itself on the attention of the most unobservant, and continued for over four weeks to be a complete nuisance to the community. It was to be seen everywhere; shop windows were rendered unsightly by their presence, dead and alive. They would enter dwellings, hiding away for the day in the folds of curtains and clothing, alarming the owners needlessly about their safety, and making themselves generally obnoxious in a hundred ways. I received inquiries concerning them from various directions, which went to prove conclusively that this state of things existed from the Niagara river on the east to the Detroit river on the west; and from the north shore of Lake Erie to the south shore of Lake Huron. How much further they extended I have not learned.

Fig. 22.

The Genus Argynnis, in some of its species, is to be seen more or less abundantly every season. But 1895 gave them forth in numbers both of species and specimens beyond all that I have ever seen before. During July there were five species on the wing at the same time. *Cybele, Aphrodite, Atlantis, Myrina*, and *Bellona*. Upon large patches of flowering weeds that were attractive to them they congregated in force, and when disturbed, they would rise in such a mass as to obscure the view beyond. It was my first experience with *Atlantis*. On the twenty-seventh of June I was in a locality where Argynnis was flying profusely. *Cybele* and *Aphrodite* were abundant, but there were some that seemed to be different from either, and with which I was not familiar. They were smaller in size and with a noticeable black border on the hind wings, so I captured some for comparison. All the *Atlantis* in the Society's collection are labelled "Montreal," and are quite uniform in size and markings. There were none of those I took that were quite so small, or with so much black in the border. On the first of July I secured more, and found that they varied considerably. Some of them I could not say whether they were small *Cybele* or large *Atlantis*, so to settle the doubt, I sent an example to Mr. W. H. Edwards, who promptly informed me that it was *Atlantis*. I saw them plentiful at Sarnia, and Mr. W. E. Macpherson, of Prescott, Ont., said it was the same at Windsor. On the sixth of August I received several specimens from Mr. Macpherson, taken by him at Prescott. They were much nearer to the Quebec type than the majority of those I took here; with a little additional black in the border of the hind wings, they might not be separable. I may state here as a matter of some interest that I never took at Hamilton what I consider to be typical *Aphrodite*, with the dark cinnamon-brown shade on the under surface of the hind wings, which is comparatively common about London, and easily obtained.

On the twelfth of August I had a call from Mr. Wm. Lochhead, of Napanee, Ont., on his way east from a visit to Windsor. When we were looking at a drawer of North American specimens that are labelled "Non-Canadian," his eye resting on *Argynnis Idalia*, he remarked: "There is a butterfly that was taken at Windsor." I had long desired to hear of that species being reported Canadian. I expected it to enter our territory in the east, but instead it has come to us in the west. Afterwards I received through the kindness of W. S. Cody, B.A., a Windsor specimen for the Society's native collection.

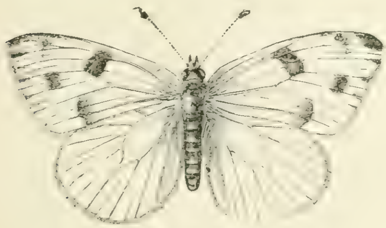


Fig. 23, Male.

Fig. 24, Female.

Pieris protodice has been seen here in greater numbers this season that it was last. It has also been reported to me from other localities. Mr. Macpherson, who spent some weeks collecting about Windsor, Ont., called upon me when he was returning east. Whilst looking over the Society's collection, when we came to the *Pieris* he pointed to the female of *Protodice*, remarking, "There is the butterfly I saw at Windsor and didn't know what it was!" An interesting testimony to its total absence of late years, which seems so strange to those to whom it was such a familiar object in times gone by. I received a letter from W. S. Cody, B.A., of Windsor, dated July 22nd, in which he said, "*Pieris protodice* appeared for the first time here about the 4th of July, although it might have been here unnoticed before that, and soon became more common than *P. rapæ.* Not being familiar with it, I took nothing but females for a while, and think they must have been more common than the males at first." We can easily understand how male *protodice* might pass unnoticed when flying with *rapæ*, Fig. 25. Mr. Anderson took males only here during July; he did not even see a female. It has also been reported to me as being plentiful at Essex, Alvinston and Woodstock.

Fig. 25.

In 1895 the season for collecting commenced early, but received a check later on. Mr. Anderson reported to me some good finds at electric light before I thought it likely that anything could have been got, light proving more profitable with him than bait throughout the season. The fascinating power of light at night seems to be general over all kinds of insects, and by concentrating it at particular points makes it easy to secure quantities of them, and gives an opportunity of estimating the comparative scarcity or abundance of the various kinds better than any other method. In this way, Mr. Anderson could have taken dozens of some kinds that I thought I was doing well to get two or three of in a season in the ordinary way of collecting. Bait will not attract some, no matter how skilfully it is compounded, and it fails with all at times; but light, especially electric light, never fails to draw, if the weather is at all propitious.

In September, I sent to Prof. J. B. Smith a box containing twenty-nine specimens of Mr. Anderson's securing, which I could not identify with anything in the Society's collection. Fourteen of these proved not to be represented therein. I had sent a few Bombycids which the Professor did not care to pronounce upon in the present transitionary

state of the nomenclature. There were some duplicates, different looking forms of one species, whilst others were varieties or better and more distinctly marked specimens of those already named in the collection. As a testimony to the character of Mr. Anderson's work, I quote from Prof. Smith's letter to me accompanying the list of names: "Your box of insects came duly to hand by express, and in good condition. It is by all odds the most interesting box you ever sent me, and contains the best species, as well as, I think, the best specimens I have ever had from you. * * * Your Nos. 2 and 5 (*Copipanolis cubilis*, Grote) are varieties of one thing, and, if you have others, I would very much like to have a specimen, since the species is not represented in my cabinet. No. 3 (*Feralia major*, Smith) is a very good species, recorded, I believe, for the first time from Canada in this sending. Your No. 11 (*Dicopis Grotei*, Morr,) is a beauty, and perhaps the handsomest specimen of the species that I have ever seen. No. 10 (*Xylomiges dolosa*, Grote) is by no means common. The other species need no special reference and are noticeable only by their excellent condition."

Amongst the Bombycids that I sent to Prof. Smith was a Gastropacha, which he gave as "*Ferruginea*, probably." This I expected would likely be so, as it corresponded well with the original description in everything except size. Packard says, Pro. Ent. Soc. Phil. Vol. III., p. 386, "A smaller species than *G. Americana*." But all the specimens that I have seen of this form are decidedly larger. In the "Preliminary Revision of the Bombyces of America North of Mexico," by Neumœgen and Dyar, *Ferruginea* is given as a variety of *Americana*. During the early part of May, *Americana* was abundant at light. This *Ferruginea* did not appear until the middle of June, and not so numerously, and the one had passed before the other appeared, which seems to conflict somewhat with the idea of their being forms of one species.

The other names of this lot that were new to the Society's collection are:

Acronycta hasta, Grote. Resembling *lobeliæ*, but smaller and darker.

Dicopis viridescens, Walk. A widely distributed species.

Mamestra detracta, Walk. The habitat of this species is given in Prof. Smith's List as Labrador, White Mountains, Colorado, 12,000 feet.

Xylophasia lateritia, Hubn. A European as well as American species.

Perigea luxa, Grote.

Scopelosoma devia, Grote. This addition completes the list of this genus in the collection.

Morrisonia evicta, Grote.

Hyblæa puera, Cram. Prof. Smith, in his catalogue, bibliographical and synonymical, gives the habitat of this species as Texas, Florida, West Indies; and remarks, "It seems to be a common form in more tropical regions and only occasional in our own fauna."

Melipotis jucunda, Hubn. This is but the second species of the genus to be represented in the Society's collection. *Limbolaris* was frequently taken about Hamilton. I am not aware of this species being reported from Canada before. The other species of this genus are all given as from the south and west.

I afterward sent a box of Bombycids to Mr. Harrison G. Dyar, who kindly determined them for me. Those of them that were new to the Society's collection of Mr. Anderson's captures are:

Lophodonta georgica, H. S.

Schizura leptinoides, Grote.

Ianassa lignicolor, Walk.

Cerura scolopendrina, Bdv. Upon this species Mr. Dyar remarks, "The specimen is of the form *Modesta*, Hud., the band broken as in *Albicoma*, Strecker." These names are varieties of *Scolopendrina*.

Mr. Anderson also secured two specimens of *Dilophonota ello*, Linn, in splendid condition; and a pair of *Protoparce cingulata*, Fab., with the pink ornamentation beautifully bright and fresh.

Fig. 26.

A rare and interesting capture by Mr. Anderson in the early part of October was a specimen of *Pyrgus tessellata*, Scudder, Fig. 26, fresh and in fine condition. It was in company with another, which he did not secure. This attractive butterfly has been reported once before from Ontario, taken by Mr. Lowe, in Essex County, and given under the synonym of *Hesperia oileus*, Humph.-West, June, 1875.

VARIATION, WITH SPECIAL REFERENCE TO INSECTS

By J. Alston Moffat, London, Ont.

"No compound of this earthly ball
Is like another, all in all."—Tennyson.

Variation amongst forms of life is one of the most interesting and evident truths in nature. The causes at work producing it are receiving a marked degree of attention at the present time, but not more than the importance of the subject deserves. No one has given thought and attention to its manifestation amongst living forms without being subjected to difficulty and perplexity by it. It lies right across the path of the investigator of the laws of life, and is the stumbling-block of the systematist. It cannot be ignored or thrown aside, but must be admitted, and a place given to it in every system in nature that is constructed.

The causes of variation in forms of life are many. Some of them are simple, apparent and easily comprehended. Others are obscure and difficult to trace. As a considerable diversity of opinion exists as to the source of its origin in nature, and the present state of our knowledge does not satisfactorily explain all that we see associated with it, therefore, an orderly statement in plain language of what is known on the subject may not prove objectionable to those who have got into perplexity and wish to investigate the subject for themselves.

All nature—that is, everything that comes within the range of physical investigation—is controlled by unchanging law. Each portion of it has a law or laws of its own, which we call the laws of its nature. We do not see these laws; we know of their existence only by observing the uniformity of their manifestations. For instance, given the same materials in the same proportions and in the same conditions, and the same results will follow every time. Change one of these by ever so little, and a different result will certainly be produced. Thus we have the ever-changing manifestations of nature from unchanging laws, through the ever changing conditions and combinations of the same materials. Life is as completely under the control of law as matter, but it is infinitely more complex and difficult to trace.

Matter has been divided into the organic and inorganic. The inorganic surface of the globe is the foundation on which rest the organic forms thereof, and from which they may be said to have come, as all the materials for their solid structures and sustenance are derived therefrom. The face of this globe has been frequently changed. There was a time when life could not exist upon it. When the conditions became favorable, organisms appeared suitable for the conditions—low in the scale of life, but neither defective nor degraded. That forms of life varied with the varying conditions of the earth's surface, is conclusively demonstrated by the geological record, and that the organisms of the various geological periods were as thoroughly in harmony with the conditions in which they lived as are those of the present. That many of the forms of life in the present are the lineal descendants of some of those of previous geological periods is extremely probable, if not positively certain, but so changed in appearance by altered conditions as not to be now recognizable.

No doubt many forms of life came and went before insects appeared. These are comparatively highly organized forms of life, the higher appearing later in point of time, life keeping pace with its surroundings, and so maintaining harmony. The conditions are not uniform over all the earth's surface at the present time, and we know that the appearance of the life of the various portions of the globe differs in many instances to such an extent that an expert can tell from what part of the world a particular form came by its appearance; and thus we learn that variation in living forms is not a thing of recent origin.

Our knowledge of the extent to which variation may go is largely obtained from man's efforts to change for his own advantage those kinds which he thought were going to prove conducive to his welfare or gratifying to his fancy. But man's methods in bringing it about are not identical with nature's. Although they must be in harmony with the laws of nature for profitable results, yet illustrations taken from one and applied to the other may be very misleading.

Wallace, in his "Island Life," page 55, says: "Few persons consider how largely and universally all animals are varying. We know, however, that in every generation, if we could examine all the individuals of any common species, we should find considerable differences, not only in size and colour, but in the form and proportions of all the parts and organs of the body. In our domesticated animals we know this to be the case, and it is by means of the continual selection of such slight varieties to breed from that all our extremely different domestic breeds have been produced. Think of the difference in every limb and every bone and muscle, and probably in every part, internal and external, of the whole body between a greyhound and a bull-dog! Yet if we had the whole series of ancestors of these two breeds before us, we should probably find that in no one generation was there a greater difference than now occurs in the same breed, or sometimes even the same litter. It is often thought, however, that wild species do not vary sufficiently to bring about any such change as this in the same time; and though naturalists are well aware that this is a mistake, it is only recently that they are able to adduce positive proof of their opinions."

In this extract we get great truths clearly stated, with a misleading inference appended. No divergence has ever appeared in the dog family in nature at all comparable to that between a greyhound and a bull-dog, and I have no hesitation in saying never would, no matter what length of time was given, and so long as the dog remained in a state of nature, we might add never could, and the reason is simple and obvious. All man's domestic animals came originally from wild forms; all the possibilities that man has disclosed were latent therein. Under domestication they became apparent, then by selection, elimination and rejection, man led one strain in this direction and another in that, concentrating and exaggerating these points of difference until the present results have been reached. Now, selection in nature is of the most indiscriminate character possible. There is a constant commingling of the slightly divergent forms going on that never gives any peculiarity an opportunity to concentrate and disclose itself very conspicuously, and if it did in one instance it would be reduced or even obliterated, to all appearance, in the next generation. And it is this sort of selection that produces and maintains that marked degree of general uniformity which we see does prevail amongst living forms in a state of nature. Thus we learn how widely divergent is the result of selection in nature from selection by man for his own benefit, the one tending to reduce variation to a minimum, the other to carry it onward to its maximum.

The most powerful influence for the producing of variation in life in nature, is to be found in external conditions. A power inherent in a locality, capable of modifying the appearance of an organism residing therein, combined with the susceptibility in varying degrees of the organism to receive, retain and transmit the impressions. That living forms are changed in appearance by residence in different parts of the globe is a fact not requiring to be proved in the present day. It has forced itself upon the attention of all observing travellers, and the books of such travellers as Darwin and Wallace are full of examples of it; and as the attention of those engaged in the investigation of nature is

being more than ever turned in this direction, illustrations confirmatory of it are being multiplied. In his later writings, Darwin acknowledged that he might not have assigned to it all the importance that it deserves, or the consideration to which it is entitled, and as investigation progresses, its influence in producing variation in nature is becoming more generally admitted. In tropical countries, where life is under a kind of forcing process, this power is strikingly exemplified in insects. There we find variation showing itself in the changed appearance of the same kinds of insects, within shorter distances and in greater numbers. Wallace tells us of one form of butterfly that he traced from the seashore inland until it was scarcely recognizable as the same species, so greatly did it change. This is an exceptional case, but the influence is present, if only the organism is sensitive enough to take the impression. Then consider, that a similar influence is at work to some extent, in some direction, on every form of insect life in the world, and we may form some conception of the tremendous power at work producing variation; for it is a fact well established by observation of life in domestication, that when a change has been brought about in an organism, it is easier afterwards to produce more and greater. But more; the same laws that are in operation at present, producing such results, have been at work ever since insects had an existence. Through all the various geological periods in which they have lived, this moulding and modifying influence has been going on, so it is not very surprising that the liability to vary should be so well established in their constitution now.

Because such a power exists in nature, we have no authority for supposing that it may go on indefinitely, and produce not only different looking things of the same kinds, but also different kinds. That would be contrary to the laws of nature as we know them, also to observation and experience. Each sphere of influence is well defined, whether we can trace it or not. It has a centre where it will be most powerful, and a circumference where it may be more weak, but if a change is to be brought about in the organism, a change must be made in its habitat, or it must be made to change its habitat. What difference would be produced by the change would have to be discovered by observation, if the organism survived it, for it is well known that conditions not necessarily fatal to life in themselves, might become so if brought about suddenly. Organisms do not change themselves by an effort of the will; this influence is external to themselves, and modifies them quite unconsciously to themselves.

What these influences are, or how they operate in producing a change in organisms, is at present but little known. Past observations point to chemical agency as a powerful factor. Indeed, in one view of it, the surface of the sphere on which we live is one huge chemical laboratory. The process of disintegrating matter and re-compounding it is perpetually going on. Then the various organisms are composed of multitudes of cells that are endowed with the power of choosing and absorbing from inorganic substances the materials required for their own special wants, and passing them on to other cells to be transmuted into the proper ingredients for the producing and sustaining of every organ in each and all, even the most complicated and highly organized beings on the earth. In the case of insects, heat and cold, moisture or its absence, light and obscurity have been shown to have an influence in changing their size and colour, the result, no doubt, of chemical combinations and actions. We see frequent instances of the same conditions producing opposite effects in different organisms, attributable to the inherent power of cells for differently combining the same materials or transmuting them chemically. And now that the conclusion has at length been reached, confirmed by correct scientific investigation, and one which harmonizes so well with all our observations and experiences, that heat does not come to us through space, but is chemically produced within our atmosphere in some way by means of the sun's rays, which are electrical, we seem to have got in some measure an explanation of how geologic and climatic influences obtain their power to modify organisms.

Although external influences are the most powerful originating cause of variation in living forms in nature, the most obvious one, and the one that attracts the most attention, is brought about by the intermingling of existing varieties, which tends to produce yet more abundant variation. The parents being unlike, we see some of the offspring

taking after one parent, some after the other, some with a curious admixture of both; whilst others have no special resemblance to either. One does not require to travel in order to obtain abundant evidence of this.

In following out this part of my subject, I shall have occasion frequently to use the term *species*, so it will be well first to define the sense in which I use it. I remark, then, that I accept without reservation Worcester's definition of the term, which he states thus:

"1. Appearance to the senses or the mind; sensible or intellectual representation.

2. An assemblage of individuals allied by common characters, and subordinate to a genus or sub-genus; a group.

In zoology and botany *species* is founded on identity of form and structure, both external and internal. The principal characteristic of *species*, in animals and vegetables, is the power to produce beings like themselves, who are also productive."

Here we have the term as used in connection with non-living matter used in classification, and as specially applied to living matter. In non-living matter, such as soils, rocks and inorganic substances generally, *species* are separated by appearances as they present themselves to the eye or mind. They are tested by the senses, when found to be different, they are pronounced to be specifically distinct. There are no differences of opinion as to their right to be called *species*; and the reason of it is, that they are inert and passive under external conditions. Specimens of the same species may be separated by thousands of miles, and that for thousands of years and no perceptible change has taken place in them. But living matter is constantly changing: from less to greater; from young to old; from vigour to decay; from one generation to another, all passing on to death and dissolution. What a gulf separates these two kinds of matter! or, if you will, the same matter under such different conditions. Now it is not in harmony with what is considered to be exact scientific phraseology, to apply the same term in the same way to two such differently constituted subjects of investigation; and separate *species* in living forms on exactly the same lines as in non living matter. Taking "appearance to the senses" as the only guide to a definite conclusion; and yet that is what has been, and is yet being done by numbers of systematists and the result is, confusion and uncertainty.

Take as an illustration of how this method works in practice, the oft quoted instance given in Darwin's "Origin of Species," p. 37. "Mr. Balington gives two hundred and fifty-one species to a given genus. Whereas Mr. Bentham gives only one hundred and twelve. A difference of one hundred and thirty-nine doubtful forms." Both are supposed to be competent authorities, why this vast difference in the result of an investigation of the same material? The answer to the question is to be found in the method of conducting it. Mr. Balington probably had a keen eye for detecting things that differ. He surveyed his material and separated it according to appearances, and when he was done he found that he had two hundred and fifty-one forms in which perceptible differences presented themselves to his mind, and he called them *species*.

Mr. Bentham was probably more critical. He might take into account the fact that living forms were always liable to vary more or less, and he would see that some of these forms so imperceptibly merged into one another, that he suspected that they were not entitled to be called *species*, so he united some here, and some there along the line, making their differences more perceptible whilst he reduced their numbers to one hundred and twelve, according to his estimate of what constituted a *species*.

Now that is exactly what might happen with any two investigators of a genus, with numerous so-called species upon this continent, who separated their *species* by perceptible differences. And that is probably what did occur in the genus that originated the "Colias Controversy," or the one that has started the Argynnis contention. Darwin himself worked on the same lines, and he has told in his own vigorous language what trouble he got into through it. He says: "After describing a set of forms as "distinct species, tearing up my manuscript and making them one "species, tearing that up and making them separate, and then "making them one again—as has often occurred to me—I have "gnashed my teeth, cursed species, and asked what sin I had committed to be so

punished ?" and such is the natural result of an effort to attain to certainty, by means of an uncertain method; and no amount of investigation upon the same lines, by ever so competent an authority, can ever be unmistakably certain. The only conclusive verdict must be obtained by an appeal to nature; unite the differing forms, and if they have "the power to produce beings like themselves who are also productive," then the species is one, and the different forms are portions of it This is the law of nature controlling all bi-sexual life, and it is extremely doubtful if there has ever been a well authenticated instance of its violation. Cases have been reported of so-called different species having been united, and the product carried forward for several generations, but that simply proves that the term *species* had been wrongly applied; and this wrong application of the term by namers and describers of species is traceable to the method of making species exclusively from perceptible differences. To illustrate the danger to which such are exposed in following that method, I quote the following passage from Wallace's Island Life pp. 55 and 56. "An American naturalist, Mr. J. A Allen, has made elaborate observations and measurements of the birds of the United States, and he finds a wonderful and altogether unsuspected amount of variation between individuals of the same species. They differ in the general tint, and in the markings and distribution of the colours; in size and proportions; in the length of the wings, tail, bill and feet; in the length of particular feathers, altering the shape of the wing or tail; in the length of the tarsi and of the separate toes; and in the length, width, thickness and curvature of the bill. These variations are very considerable, often reaching to one-sixth or one-seventh of the average dimensions and sometimes more."

We see in this extract, the perplexity that must necessarily arise in the mind of those engaged in studying such variable forms from their point of view, as to how far this sort of thing may go before it becomes a different species. Now, man has demonstrated most conclusively in connection with his domestic animals, that no amount of that kind of variation interferes in the slightest with the various forms uniting, "and producing beings like themselves, who are also productive" And the same laws are operating upon life in nature in the same way. *Species*, is a question of lineage; not of size, form or colours. These are incidental.

Having given the manner in which I use the term *species*, I continue the subject of variation.

We have seen that there are a combination of influences at work in every habitable portion of the globe, producing a change in the appearance of the life of each, in proportion to the susceptibility of the species to receive the impression. That such spheres of influence have a centre and a circumference, well defined although to us unperceived, except by the effect produced. Long residence in a locality for many generations giving the influence of that locality an opportunity to exert its utmost on the species living under it, whilst propagations with the local stock will tend to produce a more distinctive form of a species, acting as in-and-in breeding does in domestication. A fact well illustrated by the life of Islands, which is as a rule more uniform in appearance than that of continents with their extended areas.

Now it is an acknowledged fact that insects are notorious for spreading; either from their innate desire to migrate, or by external assistance. So the particular forms of one locality are constantly getting mixed with the different forms of the same species in another locality; uniting with them, "and producing beings like themselves who are also productive." It is a well-known experience of breeders in domestication, that when differing strains of the same species are united, a great uncertainty exists as to what the appearance of the offspring will be; and the greater the difference is, the uncertainty becomes proportionately greater. But more, we have to take into consideration not only the late ancestors which we may have seen, but remote ancestry which we could not see, that may have had in them strains that we never suspected, until they showed themselves in those we see.

Now this commingling of different forms of the same species is constantly going on all over the habitable globe, and given time and opportunity a species, or its descendants, could encircle the earth and produce confusion amongst the typical forms of every locality.

And when we consider that the forms of each locality are thus pushing their way outward, to mingle with those of other localities, we have an abundant source of supply for unlimited variations from the well marked and easily defined forms of any species, to the most minute shades of differences that are well calculated to drive the makers of "Species by perceptible differences" to the verge of distraction.

Let us now throw the reins to imagination, and urge it on to its utmost capacity, for it can never exceed the truth in this direction, and conceive if you can the multiplied diversity of external influences that insects have been subjected to since they were first originated up to the present time. Think of the differences of the environments they may have lived in for a greater or less extended period, and that each and all were perfectly adapted to their times and conditions, harmonizing with and fitting into them as naturally and unconsciously as water fits into a vessel. That the surface of the globe has always been diversified in climate; that insects were as susceptible to external influences, as much given to migrating and mingling together the diverse forms of the same species, and thus multiplying diversity as now; and that this and a great deal more has gone on through all the geological eras and ages that have intervened between their first appearance and the present, there seems but little cause left for wonder that *species* should be difficult to define by perceptible differences. But lest the surprise should take the opposite direction, and the wonder be that classification is possible, remember that this has all gone on under the control of unchanging laws—the laws of life and heredity, with their marvellous power of colour and form, producing beauty and attractiveness; the laws of matter and force, those that make for change and those that tend to stability; chemical affinities and combinations; brought about through light, cold, heat, and electricity; change without haste, yet without cessation; almost imperceptible, but unmistakably accomplishing results; like some huge, complicated, perfectly adjusted, self regulating machine, so absolutely perfect in its operations that it has never needed alteration or repair since it was first set in motion. Or as the fabled mills of the gods that ground very slowly but very fine, whilst the outcome of the process is what we see. Here we have "descent with modification" throughout the ages, but the same species still, if in the direct line of descent.

In such plain and evident facts of nature we seem to get sufficiently powerful and persistent causes to bring about the superabundant diversity that characterizes insect life without entering upon those that are obscure and doubtful.

The period of existence when insects are most susceptible to external influences are in the egg, larval and pupal stages. It is in these that the impressions are received which afterwards show themselves in the changed appearance of the imago. When a change has been produced in the appearance of the mature insect, a change may reasonably be expected in its early stages. Therefore when different localities are possessed of influences that are capable of making themselves manifest in the different appearance of their mature forms, and the early stages of these forms partake of a corresponding difference, and they breed true to their particular forms through all their stages, it proves nothing whatever as to their specific standing. This for conclusive settlement will require the extremes of the mature forms to be brought together, united, and see if they will produce beings like themselves, who are also productive. If so, then the species is one, regardless of their differences.

My subject would seem naturally to end here, but there are views held by some that are not in harmony with those stated, which will suggest objections that can be anticipated and may be replied to here without departing from its general scope and purpose.

Some will be ready to say, if the species is one the name should be one also. I reply, that a single description can never cover a multiform species. A constantly recurring form that requires a separate description to make it recognizable, should have a separate name. This might have the effect of reducing the number of species and increasing the number of names. Mr. W. H. Edwards has somewhere said (I quote from memory and may not be exact): "We have no such a butterfly as *Ajax*. We have *Walshii*, *Abbotii*, *Telamonides* and *Marcellus*. These four forms constitute *Ajax*." Here it requires four descriptions and four names to correctly distinguish one species. Mr. Edwards applies

that principle throughout his check list to all seasonally polymorphic butterflies. Let the same principle be followed in dealing with all sorts of variations, amongst all kinds of insects, and worked out in their classification, so far as is known, and what an amount of exact information could be conveyed at a glance as to the relationship of the different parts of any multiform species. We would have the different forms that are to be found in separated localities in the same country distinguished by name, and the forms of the same species found in other countries, continents or islands, with distinguishing names, whilst their habitat might be indicated as well. We should have also the kind of varieties, whether permanent local forms or incidental variations on these, brought about by the intermingling of separate forms, varieties wholly the result of natural operations, or produced by man's interference with the course of nature in pursuit of his own ends, and thus including the most recent variations; giving an opportunity to indicate forms that may have been exterminated through altered conditions, varieties seasonal, sexual or unaccountable, thus giving a world-wide view of every variable species according to the extent of knowledge procurable up to date, laying a solid and certain foundation for future advances in the same direction. It would be an immense convenience if *species* could be defined by appearance with certainty, but past experience has, so far, proved it hopeless. An approximation to the facts is the most that can be looked for. Ova, larvæ, and pupæ can all be classified by appearances as well as imagoes, but a system reared upon preparatory stages would fail of certainty as sure as on the mature one. No regularly graduated line can be formed of either, some inconvenient breaks are found in all. Some forms are found that will not fit in comfortably anywhere, whilst affinities are found in others that point in opposite directions. Yet for final arrangement and classification surely it is upon the affinities and resemblances of the mature form it ought to be founded, all the others being but preparatory thereto. So I conclude that the limit of *species* is found by uniting two, when the beings produced are uniformly non-productive, but the limit of variation cannot be reached until the power to produce different conditions and combinations has been exhausted.

SOME WINTER INSECTS FROM SWAMP MOSS.

By W. Hague Harrington, F.R.S.C., Ottawa.

Where are the insects in winter? What becomes of all the varied winged and painted forms that in the hot summer hours fill the air with movement and sound? Then every nook and corner of the land has its tiny familiar folk, flitting from flower to flower, in restless haste; every plant has its devouring hosts, and crawling, running, leaping creatures swarm in every direction. With the shortening days and the approach of frost, the myriads of insects, which have added so much to the joyous, exuberant life of summer, fast disappear and silence broods through forest glades and over meadow vales, which rang continuously with the shrill murmurings and stridulations of the innumerable orchestra. A few drowsy flies crawling on a sunny surface, or an occasional butterfly flitting in the midday warmth, may occur until winter has well set in, but these at last disappear. The winds strip off the dead foliage, the frost congeals the surface of the ground, and snow covers, beneath its chill pure shroud, a land from which all life seems to have departed. "All the insects are dead" the thoughtless remark, forgetting for the moment that they will be as numerous and lively in the forthcoming summer, and that none of the immense variety of forms will be created afresh.

Certainly the vast majority of the individuals, which are seen during the warmer season, perish before the close of the season, for the life of most insects is but a brief span, but the perpetuity of the species is preserved in spite of the apparent death of all the individuals. In some secure hiding places, then, the representatives of each species must remain during the long months of frost and snow. Those who have not made a study of our smaller forms of life would find it difficult to search out any of the swarms which are waiting for the vivifying breath of spring. Some might remember that our houseflies have crawled away into cracks and crevices, from which to sluggishly emerge

when it becomes warmer, but probably this would be the measure of their knowledge of the winter life of our insects. The entomologist, (concise term for the student of insect life,) however, who seeks to make himself acquainted with the complete life-history of each species,has as an essential part of his task to discover how the winter is passed. Naturally he finds that there is much diversity of habit, and that it may be either as egg, larva, pupa or imago, (adult or fully developed form) that the long cold months are safely tided over and the unbroken succession of the species preserved.

Many of our forms find security in the bottoms of the streams and pools, protected by the shield of ice which has been formed above them. Others are safely buried in the ground, beyond the reach of frost, or hidden in their burrows in our forest trees, but a great proportion are incapable of attaining such a degree of protection, and have to be content to hide in some crevice or similar shelter, or to depend upon such covering as they may be able to construct. It might well be supposed that those non-aquatic insects which hibernate in the perfect state would seek out some nice dry cranny in which, if possible, to shelter themselves from both cold and wet. Surprise may therefore reasonably be excited when it is discovered that a considerable degree of moisture seems in no degree harmful even to many species of a most delicate and fragile organization. The saturated frozen mosses of the swamps might appear the very opposite of suitable winter-quarters, and yet they very frequently contain an amazing number and variety of insects.

Having at several times gathered quantities of such mosses in the early winter, and obtained from them many interesting specimens, it has occurred to me that a brief summary of the result of my last foray of this sort might be of some interest to those who are curious as to the winter existence of our insects. I hope, too, that the list which I shall furnish may be of some little value to our many students in this branch of natural history, and may perhaps give some new light as to the habits of some of the species. For in all of our investigations we must bear in mind that, without a complete knowledge of the full yearly round of the existence of each species, we may perhaps lack just what it is most essential to know.

At the present time great attention is given to what is called economic entomology, which merely means the application to the benefit of the community at large of the knowledge which is slowly and laboriously gathered by many students, working generally merely for their own love of investigation, and often at considerable expense and self-sacrifice. At the Central Experimental Farm, at Ottawa, Canada has employed a very capable and indefatigable entomologist whose investigations and reports cannot but convey much needed information to the agricultural population. But the capacity of any man to make investigations is limited by the time at his command, and he is therefore compelled to avail himself of the labours of others, and as there is no one, especially if resident in the country and engaged in agricultural pursuits, who has not opportunity for observing the habits of some of our insects, there should be many who could render some aid to our excellent Government Entomologist, Mr. Fletcher, by communicating to him the observations that have been made. In devising methods for the destroyal and control of those insects which are classed as injurious (either to plant or animal life) it may become important to ascertain how they survive the winter, so as to know at what season they may be most easily and cheaply combatted.

Before proceeding with my list of species I will summarize for my non-entomological readers the method employed in collecting the specimens. The best localities for gathering the moss are to be found in swamps, surrounded and interspersed with trees and shrubs, and offering to the botanist in summer a considerable variety of plants. The ordinary sphagnum moss which may be found in some places is too wet to contain many insects, but the mosses which occur in abundance in somewhat drier localities will generally well repay investigation. It is profitable also to collect those which grow around the roots of trees, upon fallen logs, and upon the little knolls and hummocks of the swamps. The mosses, of course, will be mixed, more or less, with grasses, fallen twigs and leaves and various foreign matters, but the presence of these is not a source of any inconvenience in examining the material collected. A sackful gathered in the nearest swamp will furnish interesting occupation for many subsequent hours, and its contents

can be examined as opportunity offers. A damp, cool cellar is the best place to keep it until such opportunities occur. For the examination of the moss, take a shallow box, several inches square and about three deep, and replace the bottom by fine wire netting of about eight holes to the linear inch. Placing this box upon a sheet of white paper, a handful of moss is torn to pieces in it, and the insects which may be present will fall through the netting. Before emptying the debris out of the box give the latter a sharp tap to dislodge any that may be "playing possum" or clinging to the wire. The insects which are now seen scampering off at different rates of speed may be picked up with a fine forceps or the moistened tip of a camel's hair pencil, and dropped in a small phial of alcohol or a cyanide bottle. It is well, if possible, to do this work in an uncarpeted room, or one in which a few spiders and other forms which will surely escape, may not create any disturbance. Spiders especially display great alacrity in making themselves scarce, and there are many beetles that are most agile in their movements, and even if picked up in the forceps will wriggle out and dart off in a new direction, always aiming, however, for the farthest edge of the table.

By adding the species collected in previous years my lists could be lengthened but I intend to confine them to the results obtained from the gathering of one season. The material examined consisted of about a peck collected on 17th Nov., about the margins of a little swampy inlet below the aboretum of the Experimental Farm, and the contents of an ordinary grain-sack filled, six days later, in Dow's swamp, (a regular cedar and tamarac marsh) upon the opposite side of the canal. At the latter date the surface of the ground was frozen and some snow had fallen, so that the moss was partially frozen and mixed with snow, making the bag pretty heavy for portaging, and I remember that, when I boarded an electric car with my burden, it provoked general curiosity (which remained unsatisfied) on the part of my fellow passengers. I have separate records of the insects from each place, but as the dates and localities were so near together I shall give but one list of the coleoptera, hemiptera and hymenoptera with the joint number of individuals of each species, to show their relative abundance.

The total number of species enumerated is 147; of which 52 occurred in both localities, 59 in Dow's swamp only and 36 at the Experimental Farm only. The number of individuals mounted and examined was 1,345, of which 889 were from the swamp and 456 from the Farm. These figures do not represent all the insects yielded by the moss, for of several of the commoner species no attempt was made to save all the examples, while some individuals escaped in spite of all attempts to capture them. In addition there were numerous individuals belonging to some of the other orders of insects, such as flies, thrips, and spring-tails, of which there were several varieties always leaping around. There were also many allied forms, such as mites, spiders, chelifers and myriapods. Among the many larvæ of various kinds may be noticed especially one which was not infrequent, and which afforded apparently a striking instance of protective mimicry. This was the larva of some fly, in which the segments of the body were so shaped and ornamented as to give the creature, which was of a bright green colour, an exact resemblance to a fragment of the moss.

The several varieties of moss contained in this gathering formed in themselves an interesting subject for examination, and in addition to the various forms of life already noted there were many examples of several of our smaller molluscs. Of these there were probably more than a dozen species, and they were preserved and handed over to one of my conchological friends to add to his collections and records. The examination of the moss was not concluded for several weeks, and it was found that its occupants remained alive and active so long as it was not allowed to become too dry, or was not exposed to excessive cold. Many of the insects proved most interesting and several had not previously been found by me. I regret that about one-third of the species have not yet been satisfactorily named, which indicates that the knowledge of our insects is yet very imperfect, and that more students are needed in the entomological field.

Coleoptera.

Carabidæ.

Bembidium variegatum *Say*	2
sulcatum *Lec*	6
Pterostichus femoralis *Kirby*	12
Platynus picipennis *Kirby*	2
Lachnocrepis parallelus *Say*	1
Oodes fluvialis *Lec*	1
Tachycellus nigrinus *Dej*	3

Dytiscidæ.

Ilybius ignarus *Lec* ?	1
Ilybiosoma bifarius *Kirby*	1
Agabus sp.	1

Hydrophilidæ.

Hydrochus subcupreus *Rand*	3
Hydræna pennsylvanica *Kies*	6
Philhydrus perplexus *Lec*	2
sp	2
Hydrocombus lacustris *Lec*	8
Hydrobius feminalis *Lec*	8
fuscipes *Linn*	1
subcupreus *Say*	6
Cercyon sp	2
Cryptopleurum vagans *Lec*	14

Silphidæ.

Colon sp	4
sp	1
Clambus puberulus *Lec*	1

Scydmænidæ.

Scydmænus fossiger *Lec*	40
sp. (small)	27

Pselaphidæ.

Ctenistes piceus *Lec*	6
Pselaphus erichsonii *Lec*	15
Tychus longipalpus *Lec*	1
Decarthron abnorme *Lec*	3
Ratrisus globosus *Lec*	1
Bryaxis conjuncta *Lec*	68
rubicunda *Aubé*	9
propinqua *Lec*	128
Trimium sp	1

Staphylinidæ.

Falagria bilobata *Say*	6
dissecta *Er.* ?	1
Aleochara nitida *Grav*	4
sp	1
? sp	1
Dinopsis americanus *Kraatz*	1
Acylophorus pratensis *Lec*	2
Philonthus lomatus *Erich*	4
nigritulus *Grav*	7
decipiens *Horn*	2
Diochus schaumii *Kraatz*	16
Stenus femoratus *Say* ?	28
erythropus *Melsh*	2
pusio *Casey*	4
caniculatus *Gyll*	9
croceatus *Casey*	2
Euæsthetus americanus *Er*	3
Lathrobium punctulatum *Lec*	1
bicolor *Lec*	1
concolor *Lec*	2
simplex *Lec*	2
sp	1
Stilicus dentatus *Say*	6
Lithocharis sp	8
Sunius binotatus *Say*	1
brevipennis *Aust*	2
Tachyporus jocosus *Say*	1

Staphylinidæ—*Continued.*

Tachyporus brunneus *Fab*	12
Conosoma sp.	2
Boletobius sp	1
Mycetoporus americanus *Er*	5
Olisthærus substriatus *Gyll*	1
? sp.	1
? sp.	44
? sp.	14
? sp.	5

Trichopterygidæ.

Trichopteryx sp	116
sp	6

Scaphidiidæ.

Scaphisoma convexum *Say* ?	2

Corylophidæ.

Artholips marginicollis *Lec*	23

Coccinellidæ.

Hippodamia 13-punctata *Linn*	1

Cucujidæ.

Læmophlæus convexulus *Lec*	1

Cryptophagidæ.

Atomaria ephippiata *Zimm*	45
sp. (brown)	38
sp. (black)	1
sp. (small red)	24
? sp	3

Nitidulidæ.

Omosita colon *Linn*	2
Ips fasciatus *Oliv*	4

Latridiidæ.

Stephostethus liratus *Lec*	1
Corticaria pumila *Lec*	53
cavicollis *Mann*	3

Byrrhidæ.

Cytilus sericeus *Fab*	2

Dascyllidæ.

Cyphon variabilis *Thunb*	3

Throscidæ.

Throscus alienus *Bonv*	1

Buprestidæ.

Taphrocerus gracilis *Say*	1

Chrysomelidæ.

Donacia Kirbyi *Lac*	1
Chætocnema subcylindrica *Lec*	5
Odontota nervosa *Pang*	2

Otiorhynchidæ.

Otiorhynchus ovatus *Linn*	2

Curculionidæ.

Apion sp	1
Phytonomus nigrirostris *Fab*	35
Listronotus sp	1
Macrops sp	3
Tanysphyrus lemnæ *Fab*	1
Acalyptus carpini *Hbst*	1
Pelenomus squamosus *Lec*	2
Cœliodes nebulosus *Lec*	1
? sp.	2

Notes on the Coleoptera.

Two-thirds of all the species belonged to the Coleoptera, or insects in which the hind pair of wings, when present, are the organs of flight, and are protected by the thickened front pair, known as elytra. A large proportion of our beetles are ground-dwellers, roving about through the herbage and moss, or hiding under stones and rubbish, and these are best represented. Many of these are predaceous; the remainder feeding chiefly upon decaying animal or vegetable matter, and comparatively few attacking living plants. In the above list twenty-two families are represented by 103 species, of which forty occurred in both gatherings, while twenty-seven were peculiar to the Farm and thirty six to the swamp. The former locality furnished 383 individuals and the latter 594, so that, with the beetles that escaped or were not preserved, there were considerably over 1,000 examples in these mosses, which certainly shows that they were pretty thickly distributed throughout the swamps.

Of the seven species of Carabidæ, *Oodes fluvialis* was a new record for Ottawa, while *Lachnocrepis parallelus* is also an uncommon species here These beetles were found under the thick covering of a prostrate log, and were in shallow cells in the earthy matter on which the moss grew, evidently prepared to abide the winter there, as is done by other members of this family. The Dytiscidæ and Hydrophilidæ are aquatic or sub-aquatic beetles, although many of the smaller species live largely in decaying vegetable matter. The Pselaphidæ, a family well represented both in species and individuals, contains very small forms, which are stated to feed upon animal substances, and probably subsist in part upon other small inhabitants of the moss. *Bryaxis propinqua* and *B. conjuncta* are remarkably abundant, especially in Dow's swamp. Nearly one-third of all the species of Coleoptera belong to the Staphylinidæ, a very extensive family which I have not found time properly to study and of which there are many unnamed species in my cabinets, even of the commoner forms. These beetles are slender, depressed, elongated insects, with short elytra, remarkably quick and erratic in their movements, and living chiefly on decomposing animal or vegetable matter. The genus Aleochara contains, however, true parasitic species.

Of all our beetles the smallest species are those that belong to the family with the very long name, Trichopterygidæ, which signifies that they have wings fringed with hairs. One species was present in great numbers, and although mere black specks on the white paper the beetles are very nimble and run swiftly about. The members of the Cryptophagidæ and Lathridiidæ are also very small, and subsist upon fungi and decaying vegetation. One of the most interesting beetles of the list is the pretty little *Taphrocerus gracilis*, the only buprestid I have ever found hibernating. This species is taken with the sweeping net in low meadows in June and I believe the larva feeds in the stems of the sedges or large grasses. All the rest of the beetles are plant-feeding, and the most abundant species, *Phytonomus nigrirostris,* is known as a clover-pest.

Hemiptera.

Corimalæna pulicaria *Germ*	5	Coriscus inscriptus *Kirby*	1
Neotiglossa undata *Say*	1	Salda sp. undescribed	1
Cymus angustatus *Stal*	5	Ulopa canadensis *VanDuzee*	62
Salicia pilosula *Stal*	3	Acocephalus mixtus *Say* ?	6*
Scolopostethus affinis *Schill*	2	Helochara communis *Fitch*	4*
Lygus flavonotatus *Prov*	2	Philaenus sp.	1
Corythuca arquata *Say*	7	Livia vernalis *Fitch*	1
? sp.	17*		

Notes on the Hemiptera.

The species of Hemiptera include ten belonging to the division Heteroptera and five to the Homoptera. They were more abundant in the drier mosses. Seven species were common to both localities and four peculiar to each. The total number of individuals was 118, of which more than half belonged to the curious short-winged species which Mr.

VanDuzee has named *Ulopa canadensis* and which has been noted previously as occurring in Ottawa. Mr. Kilman has also found the species at Ridgeway, and it is probably widely distributed. The specimens marked with an asterisk were nymphs, or immature forms, so that the species could not be exactly determined. The insects belonging to this order are the only forms properly entitled to the name "bug," and they are mainly plant-feeding. Subsisting upon the juices, which they suck from the leaves and stems by means of the tubular beak formed by the prolongation of the mouth-parts, they rank among the insects most injurious to plant life, and are most difficult to destroy or keep in check. The smaller forms, known as plant-lice, are very numerous in species, and they multiply with great rapidity, so that a very brief time suffices for the attacked plant to become quite covered by the immense number in all stages of growth, and to have its vitality exhausted.

HYMENOPTERA.

PROCTOTRYPIDÆ.	
Megaspilus ottawaensis *Ashm*	5
Ceraphron minutus *Ashm*	4
flaviscapus *Ashm*	2
carinatus *Ashm.* ?	5
mellipes *Ashm.* ?	2
Aphanogmus bicolor *Ashm.*	8
Telenomus sp	1
Acoloides subapterus *Ashm.*	4
seminiger *Ashm*	1
sp. nov. ?	1
Bæus minutus *Ashm*	47
Prosacantha melanopus *Ashm*	1
Hoplogryon brachypterus *Ashm*	41
sp. nov. ?	1
Gryon canadensis *Ashm*	68
borealis *Ashm*	3
Paramesius clavipes *Ashm*	2
Diapria sp	1
Trichopria carolinensis *Ashm*	4

PROCTOTRYPIDÆ—*Continued.*	
Trichopria sp. (apterous)	2
sp	1
Phænopria aptera *Ashm*	16
hæmatobiæ *Ashm*	10
MYMARIDÆ.	
Cosmocoma sp	2
FORMICIDÆ.	
Camponotus marginatus *Latr*	1
Lasius brunneus *Latr*	1
Tapinoma erraticum *Nyl*	1
MYRMICIDÆ.	
Myrmica lobicornis *Nyl*	14
sp	1

NOTES ON THE HYMENOPTERA.

That this order should be so well represented will probably be a matter of much more surprise than the occurrence of a large number of the ground-frequenting beetles. One is apt to think of its members, in their adult form at least, as delicate-winged forms flitting about in the sunshine. But besides the ants there are many wingless or sub-wingless forms belonging to the various parasitic groups. Nearly half of the species in the above list belong to these non-flying hymenoptera, but the remainder have fully developed wings. It will be seen that twenty-nine species are enumerated, of which five occurred in both localities, five at the Farm only (of which four were ants) and nineteen only in the swamp, which was decidedly the most prolific ground, yielding 218 out of the 250 specimens collected. Many more ants could have been collected, for their nests, some of considerable size, were scattered all through the swamp, but those secured were stragglers that had probably got lost in their wanderings, and had not been able to reach home before the cold weather stopped their journeyings. With the exception of these ants all the species are very minute, and belong to the family Proctotrypidæ; except one species belonging to the Mymaridæ, a small group formerly included in the Proctotrypidæ but which Mr. Ashmead considers should constitute a separate family. The first six species belong to the sub-family Ceraphroninæ, whose members are parasitic on Aphididæ (plant lice) and Cecidomyiidæ (midge-like flies forming gall-like swellings, etc.). The following ten species belong to the sub-family Scelioninæ, all of which are egg parasites, the larvæ living in the eggs of other insects. I have bred as many as thirty-one individuals of a species of Telenomus from two eggs of one of our large moths, but usually one parasite occupies each egg. Seven species belong to the sub-family Diapriinæ, parasites of the larvæ of flies. The most abund

ant form was the wingless *Gryon canadensis*, of which all but five specimens were from Dow's swamp. The closely allied, short-winged *Hoplogryon brachypterus* was almost as numerous, three of the specimens being from the Farm. The second in point of numbers was *Bœus minutus*, which occurred only in the mosses from Dow's swamp. Probably some individuals escaped my notice when I was sifting the moss, as it is much the smallest species in the list. It is a very agile atom, and able to leap a considerable distance, while even the least dust upon the paper suffices to hide it, as it is a mere speck itself The whole forty-seven specimens placed head to tail would make a line hardly an inch in length. As the members of this genus are parasitic in the eggs of spiders this minute species will probably infest the eggs of some of our smaller spiders, but I have not yet succeeded in breeding any. The Cosmocoma is a fragile little form with narrow wings, interesting chiefly as being the first mymarid which has been captured by me, and probably the first recorded from Canada. In conclusion, it is hoped that these imperfect lists and notes thereon may stimulate further observations on the winter habits of Canadian insects.

BIRDS AS PROTECTORS OF ORCHARDS.*

By E. H. Forbush, Ornithologist of the Massachusetts Board of Agriculture.

Having had, during the last twenty years, some opportunity for observing the food habits of birds, I have become convinced that they destroy enormous numbers of insects. This conviction gives rise to the question, to what extent are birds useful to man in this respect?

The present paper is merely a partial record of the results of an attempt to foster and protect birds in an old and neglected orchard with a view to observing the effect of such a policy upon the trees. The orchard is so situated as to be a favorite haunt for birds. It forms part of an estate in Medford, Mass., lying near the southern border of the stretch of wooded rocky hills known as the "Middlesex Fells," a large part of which is now under the control of the Metropolitan Park Commission of Massachusetts, and is being administered as a forest reservation. The nearest estates on the east and west of the orchard are cultivated to some extent. There are other orchards in the immediate vicinity, and many fine and large shade trees. There are also on the estate in question many varieties of trees and shrubs. There is a small piece of woodland, covering perhaps an acre and a half, in which yellow pine predominates, the other trees being principally ash, oak and maple, some hickory and a few white pines. A lane running along the southern border of the estate is bordered on both sides with elms and poplars. A line of mulberry trees along the lane south of the orchard affords tempting food for such birds as are fond of fruit in its season. There are also many wild cherries and berries of several varieties, together with half a dozen trees of cultivated cherries.

Among the trees, shrubs and vines found on the estate and which furnish food for birds in the shape of berries or seeds at certain seasons of the year are the *Berberis vulgaris* (common barberry), *Vitis labrusca* (northern fox grape), *Rhus toxicodendron* (poison ivy), *Prunus Americana* (wild yellow plum), *Prunus Pennsylvanica* (wild red cherry), *Prunus Virginiana* (choke-cherry), *Prunus avium* (English cherry), *Rubus occidentalis* (black raspberry), *Rubus villosus* (high blackberry), *Rubus idæus* (garden raspberry), *Rosa nitida* (wild rose), *Pyrus malus* (common apple), *Ribes rubrum* (common red currant), *Fraxinus Americana* (white ash), *Morus rubra* (red mulberry), *Quercus alba* (white oak), *Quercus coccinea* (scarlet oak), *Pinus strobus* (white pine), *Pinus rigida* (pitch pine), *Thuja Canadensis* (hemlock), *Juniperus Virginiana* (red cedar).

The orchard itself is a typical old orchard, such as is often found on small farms. It has suffered greatly from neglect. Two-thirds of the original trees have died or are in the last stages of dissolution. This is largely the result of neglect and improper pruning. Dead limbs and hollows in the trees have offered nesting places for such birds as the wren, woodpecker and bluebird.

* Reprinted from *The Museum* by kind permission of the author.

For three years, from 1891 to 1893, inclusive, the trees were trimmed and cared for. They were sprayed or banded to protect them from canker worms, and the "nests" of the tent caterpillar (*Clisiocampa Americana*) (Fig. 27), were removed. The result was a scanty yield of apples from most of the trees. One or two bore quite plentifully.

In order to observe the effect of the feeding of birds in the orchard, no care was taken in 1894 to protect the trees. During that year the tent caterpillars were very numerous in the vicinity, and it became evident also that a great increase in the the number of canker-worms was taking place in the neighborhood. Although these insects made considerable inroads upon the trees, they did not seriously injure the foliage anywhere except in one or two instances. No attempt was made previous to 1895 to foster or encourage the birds in the neighborhood, except that a few nesting boxes were put up in 1894, which were occupied in one case by a family of wrens, and in another by the English or house sparrow. We were careful, however, to destroy the nests of the house sparrow.

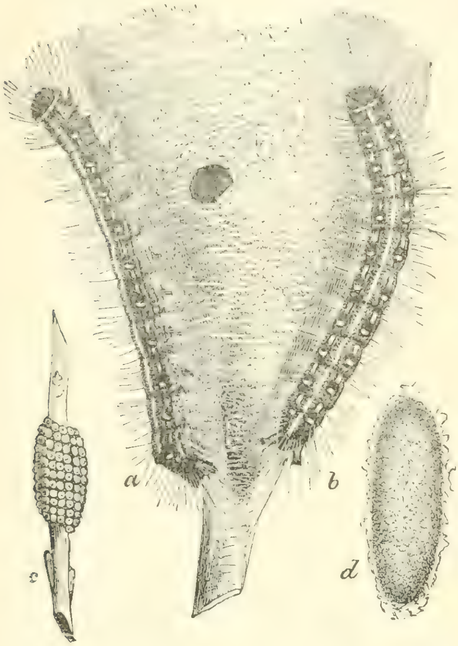


Fig. 27.

Fig. 28.

In the fall of 1894 it was noticed that immense numbers of the wingless females of the fall canker-worm (*Anisopteryx pometaria*) (Fig. 28, *b*), were ascending nearly all the trees and depositing their eggs; also, that the eggs of the tent caterpillar moths were numerous upon the twigs promising a plentiful supply for 1895.

Having allowed the insects one year to increase unmolested by man, we began in the winter of 1894 95 to encourage the presence of birds in the orchard.

In 1894 a small tree in the centre of the orchard had been enclosed by a high board fence. The tree thus enclosed was used as an outdoor experiment station for observation on the breeding and habits of the gypsy moth. During the winter 1894-95, Mr. O. E. Bailey made frequent visits to this tree to ascertain whether or not the birds were destroying the eggs of the gypsy moth. Incidentally, Mr. Bailey observed many interesting things in connection with the feeding of the birds on the eggs, larvæ and pupæ of insects which wintered on the trees, and I am greatly indebted to him for many interesting notes on the feeding of birds in this orchard. He is a careful, conscientious observer, and is intimately acquainted with most of our native land birds.

Hunters and trappers are aware that many species of winter birds, such as titmice, woodpeckers, crows, jays and nuthatches are attracted by a skinned carcase suspended from a limb, and will remain in the vicinity until all the bones are picked clean or until, with the approach of spring, insect food becomes more accessible.

Believing from my own observations that the chickadees (*Parus atricapillus*) were feeding on the eggs of the fall canker-worm, I asked Mr. Bailey to attract the birds, if possible, to the orchard by suspending pieces of meat, bone, suet, etc., from the trees.

These food materials are suitable for birds at times when the trees are covered with snow or ice and when, lacking such nourishment, they might starve. Although birds will frequently visit bait provided for them and in time will eat a considerable portion of the meat, they do not depend entirely on this aliment, but spend the greater portion of their time in searching for insects and eggs in the immediate vicinity.

Finding a plentiful supply of food, the chickadees remained about the orchard most of the winter, except for a week or two, when the meat gave out, but they were lured back again later by a fresh supply which was placed in the trees. Not only were the chickadees attracted to the orchard in large numbers, but other birds came also. A pair of downy woodpeckers (*Dryobates pubescens*) and two pairs of nuthatches (*Sitta carolinesis*) were frequent visitors, and a few brown creepers (*Certhia Americana*) came occasionally. All these paid frequent visits to the meat and suet, and also thoroughly inspected the trees in search of insect food. They made excursions also to the trees in the neighborhood, but the greater portion of their attention was confined to the orchard in which the bait was suspended. As they became more accustomed to Mr. Bailey's presence they grew quite tame, and could be viewed at a distance of a few feet. Indeed, chickadees frequently alighted on his person and occasionally took food from his hand. He was thus enabled to determine accurately (without killing them) what they were feeding upon, and was soon convinced that they were destroying the eggs of the canker-worm moth in large numbers, as well as the hibernating larvæ and pupæ of other insects injurious to trees.

To determine how many eggs a single chickadee would eat, a few birds were killed and their stomach contents examined, with surprising results. There was no difficulty in identifying the eggs of the canker-worm moth which were found in the birds' stomachs, as a great portion of the shells remained intact. The other insect contents of the stomachs

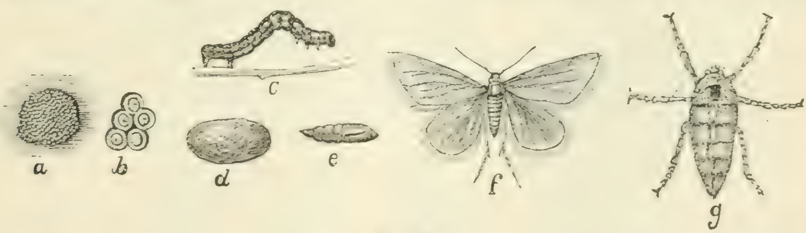


Fig. 29.

were identified for me through the kindness of Mr. A. H. Kirkland, B.Sc., assistant entomologist of the State Board of Agriculture, who made the examinations. Although it was impossible in all cases to learn with certainty the species to which certain insects belonged, it was evident that they belonged to the genera known to be of injurious habits.

I take the following from Mr. Bailey's notes:

Number of Eggs of the Fall Canker-Worm found in Stomachs of Chickadees.

No. 1	273 eggs.
" 2	261 "
" 3	216 "
" 4	278 "

Making in all 1,028 eggs found in the stomachs of four birds. Four birds killed later in the season had eaten the female imagos of the spring canker-worm (*Palæacrita vernata*), (Fig. 29, *g*), as follows:

No. 1	41 moths.
" 2	18 "
" 3	27 "
" 4	19 "

Making a total of 105. In No. 2, 3 and 4 of the last table there were a large number of eggs also. It is safe to say that there were 150 eggs in each stomach, in addition to the female moths eaten.

Mr. Bailey carefully counted the eggs in the ovaries of twenty of these female moths, with the following results:

No. 1	158	No. 11	111
" 2	272	" 12	160
" 3	127	" 13	193
" 4	184	" 14	131
" 5	213	" 15	281
" 6	135	" 16	242
" 7	140	" 17	116
" 8	220	" 18	281
" 9	200	" 19	192
" 10	130	" 20	217

It will be seen from this table that the average number of eggs found in each moth is 185. Mr. Bailey is very positive, from his continuous field observations, that each chickadee will devour on the average thirty female canker-worm moths per day from the 20th of March until the 15th of April, provided these insects are plentiful. If the

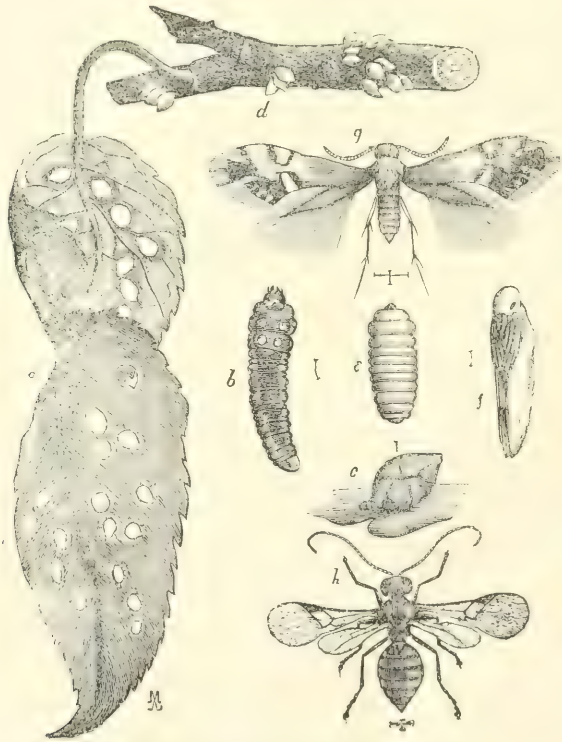


Fig. 30. (Aspidisca splendoriferella.)

average number of eggs laid by each female is 185, one chickadee would thus destroy in one day 5,550 eggs; and in the twenty-five days in which the canker-worm moths "run" or crawl up the trees, 138,750. It may be thought that this computation is excessive, and it is probable that some of the moths were not captured until they had laid some of their eggs, but the chickadees are also busy eating these eggs. When we consider further that forty-one of these insects, distended as they were with eggs, were found at one time in the stomach of one chickadee, and that the digestion of the bird is so rapid that its

stomach was probably filled several times daily, the estimate made by Mr. Bailey seems a very conservative one. He now regards the chickadee as the best friend the farmer has, for the reason that it is with him all the year, and there is no bird that can compare with it in destroying the female moths and their eggs. It was noticed that the birds made no attempt to catch the male moths. This, however, cannot be considered as a fault, for the birds accomplish far more by destroying the females than they would by killing males.

The following notes from the preliminary examinations of the contents of the alimentary canal of chickadees made by Mr. Kirkland are of interest in this connection :

"Bird brought in by Mr. Bailey, March 16, 1895 : Gullet empty. Gizzard contained 270 canker-worm eggs (*Anisopteryx pometaria*), forty-six case-bearers (microlepidoptera), six cocoons, Fig. 30*d*, of a small tineid (near *Aspidisca*). These three kinds of food in bulk composed eighty per cent. of the gizzard contents, the remainder being dark material which I was unable to determine under a hand lens. I think it very probable that part of this was bits of bark or particles of bark dust taken in with the eggs or cocoons. The intestine contained a large quantity of meat, seventy-five per cent., and 103 canker-worm eggs, ten per cent., the remainder, fifteen per cent., being material which I could not identify. It was not meat. This gives us as totals, 373 canker-worm eggs and fifty-one microlepidoptera.

"Specimens of so called 'scales' on apple twigs brought in by Mr, Bailey, March 12, 1895. These are not bark lice, but the cocoons of a microlepidopteron, probably a tineid. Length 1-12 to 1-8 inch : width, 1-12 to 1-10 inch ; elliptical, dark brown or reddish brown. They are closely spun, the upper surface apparently being of leaf epidermis, while underneath is a small well-formed cocoon which contains a minute green larva which evidently hibernates as such, probably pupating in the spring. The larva undoubtedly feeds on the leaves of the apple-tree, as these cocoons were taken from the small twigs at the extreme end of a large branch. Some of these cocoons are empty and have a minute hole at one end, which probably served for the egress of some small parasite. These cocoons are eaten by the chickadee, and have been found in the gizzard of the birds."

The case bearers and the tineids or leaf miners are injurious to the foliage of the apple-trees.

It was noticed by Mr. Bailey, who watched the birds closely for several days, that they were eating quantities of both of these insects. It would have been impossible for any one to determine the species of the leaf miners as found in the birds' stomachs, for little remained but small fragments of the shell of the creature. Mr. Bailey noticed that the birds were taking objects from the twigs, some of which they ate ; others they rejected and dropped upon the snow. Some of those dropped he picked up and examined, finding them to be parasitized. The birds undoubtedly ate only those which were alive.

It was evident from a careful examination of the eggs found in the stomachs of the chickadees that they were either broken by the bill in such a way that the contents were exposed to the action of the gastric juice or the gastric fluid destroyed a portion of the shell. Occasionally a few eggs which appeared to be whole were found in the intestines.

A great quantity of animal food is required to sustain life and provide animal heat sufficient to enable these little birds to resist the inclemency of our severe winters. In proof of this it may be stated that during favorable weather the birds visited the meat and ate largely of it three times each hour with fair regularity. During each interval they were occupied in destroying eggs and other hibernating insect forms which were always present and numerous in the stomachs examined. This feeding appeared to be almost continuous except in severe storms when the birds sought shelter or when they were laboring under excitement caused by fear, as in the case of a visit from a hawk, cat or shrike. Whenever a cat appeared they immediately hid behind the branches and remained quiet until the intruder had passed. The appearance of other enemies or the firing of a gun would produce much the same effect.

The woodpeckers and nuthatches which frequented the orchards, were not seen to eat the eggs of the canker-worm moth. As they were not numerous, none were killed. Mr. Bailey observed, however, that the nuthatches were eating scales which they found on the limbs of the apple-trees in a neighboring orchard. In relation to these scales the following note from Mr. Kirkland is of interest :

"March 20, 1895 Mr. Bailey brought in specimens of apple twigs infested with the Bark Scale louse, *Mytilaspis pomorum*, Fig. 31. He reported that the nuthatch was feeding on them. These twigs were infested in a worse manner than I have ever seen before. They were literally covered with the scales. On one small twig, one-half inch in diameter, I counted 367 scales on one inch of the twig. The eggs contained in a number of scales varied from sixty-two to eighty-two, with an average of seventy."

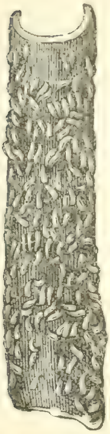


Fig. 31.

These scales, when numerous, are very injurious to the apple-tree. Each scale covered a dead female of the preceding year and the hibernating eggs, many of which must have been disposed of by the nuthatches. I was shown, both by observation and dissection, that birds feeding in the same neighborhood and upon the same trees showed considerable variance in the character of their food. Kinglets taken, had no canker-worm eggs, but had eaten largely of bark borers. Woodpeckers seemed to confine themselves to the larvæ of borers and to wood-ants and other insects which bore into the wood of the tree. Chickadees and nuthatches ate the pupæ and eggs of insects found upon the bark or in the crevices of the trunks. No birds were seen to eat the eggs of the tent caterpillar, nor were any found in the stomachs of any of the birds examined. It seems probable that these eggs are so protected by a hard covering that they are not eaten by most birds.

It is impossible, in the limited space at our command, to give results of all observations and dissections in detail. We can merely give the apparent results of the presence of the birds in the orchard.

It was found that these birds were not only destroying the eggs of the canker-worm in this orchard, but were feeding on the eggs of the same insect in the woods where bait had been suspended.

As the frost left the ground on the first warm days of spring the wingless females of the spring canker-worm moth appeared in the orchard and began ascending the trees in great numbers. The chickadees commenced catching and eating the females and their eggs. Mr. Bailey placed twenty-two of the females on one tree, and in a few minutes twenty of them were captured and eaten by chickadees.

It was noticed as spring approached and insects became more numerous that the chickadees came very seldom to the meat. They were not as assiduous in their attention to the orchard, and a small portion of their food consisted of the early gnats which were flying on bright sunny days. In early April they had nearly deserted the meat, although they still frequented the orchard in search of the female canker-worm moths. They seemed to prefer animal food to all other, and even in cold weather would hardly notice grain or seeds of any kind, though one individual ate a few oat kernels which were placed near his accustomed feed of meat.

Towards the last of April the English or house sparrow (*Passer domesticus*) began to make its appearance in the vicinity and apparently drove the chickadees to the woods, as they disappeared and did not nest in the orchard, but remained in the woods, where they paired and nested.

I believe that the English sparrow is largely responsible for the fact that chickadees are not now found nesting in our orchards. Though they still nest in the orchards on the remoter farms and in the villages where the English sparrow is not numerous, they seem to have disappeared in summer from orchards near cities. At the time of the advent

of the sparrow in this locality, twenty-five years ago, chickadees were often found nesting in old apple trees in the orchards in this region where now scarcely any are to be seen in orchards during the summer.

In the latter part of April and in early May the tent caterpillars made appearance on the apple and cherry trees in the neighborhood. Canker-worms were also numerous on the apples and elms and appeared in some of the other trees. It was noticed, however, that while trees in neighboring orchards were seriously infested with canker-worms and to a less degree with tent-caterpillars, those in the orchard which had been frequented by the chickadees during the winter and spring were not seriously infested, and that comparatively few of the worms and caterpillars were to be found there.

With the warm south winds of May, many summer birds came and settled in the neighborhood and prepared to build their nests, among which the following were seen: Chickadee (*Parus atricapillus*), Tree Sparrow (*Spizella monticola*), Crow (*Corvus Americanus*), Purple Grackle (*Quiscalus quiscula*), Flicker (*Colaptes auratus*), Red-winged Blackbird (*Agelaius phœniceus*), Robin (*Merula migratoria*), Chipping Sparrow (*Spizella socialis*), Ovenbird (*Seiurus aurocapillus*), Wood Thrush (*Turdus mustelinus*), Catbird (*Galeoscoptes carolinensis*), Brown Thrasher (*Harporhynchus rufus*), Black-billed Cuckoo (*Coccyzus erythropthalmus*), Yellow-billed Cuckoo (*Coccyzus Americanus*), Black and White Warbler (*Mniotilta varia*), Yellow Warbler (*Dendroica æstiva*), Chestnut-sided Warbler (*Dendroica Pennsylvanica*), Black-throated Green Warbler (*Dendroica virens*), Pine Warbler (*Dendroica vigorsii*), House Wren (*Troglodytes ædon*), American Redstart (*Setophaga ruticilla*), Nashville Warbler (*Helminthophila ruficapilla*), Golden-winged Warbler (*Helminthophila chrysoptera*), Scarlet Tanager (*Piranga erythromelas*), Rose-breasted Grosbeak (*Habia ludoviciana*), Baltimore Oriole (*Icterus galbula*), Blue Jay (*Cyanocitta cristata*), Least Flycatcher (*Empidonax minimus*), Wood Pewee (*Contopus virens*) Phœbe (*Savornis phœbe*), Kingbird (*Tyrannus tyrannus*), and Downy Woodpecker (*Dryobates pubescens*).

It was noticeable that early in the season, when the webs of the tent-caterpillar (Fig. 27) first appeared on the apple and cherry trees, the orioles attacked them and devoured a considerable number of the hairy young larvæ. A little later, when the canker-worms became more numerous, it seemed as if all the birds in the neighborhood were intent on eating canker-worms, neglecting to a certain extent the hairy caterpillars. The cuckoos, however, seemed to feed impartially on both the canker-worm and the tent caterpillar.

Birds from all quarters in the wood and swamp, orchard and field, flocked into the trees infested by canker-worms, and there spent a considerable portion of their time. In a short time the few canker-worms remaining in the old orchard were apparently eaten by birds, and the birds then directed their attention to the neighboring orchards, which were swarming with the worms It soon became evident that these orchards would be entirely stripped of their leaves, while the old orchard retained its full foliage. Thus it was seen that the trees to which the chickadees had been lured during the winter had been so well protected that the summer birds were able to destroy the few remaining larvæ, while the trees at a distance from these contained so many larvæ that the birds were not numerous enough to dispose of them or to make any effective reduction in their numbers. This apparently demonstrated the usefulness of the egg-destroying winter birds, and showed the wisdom of attracting them to the orchard during the winter months. Not only did nearly all species of birds in the neighborhood flock to the trees infested by the canker-worms, but the chickadees, living in their retirement in the woods, came out to the orchards, flying some distance to procure canker-worms with which to feed their young, and making regular trips to the infested trees day after day.

On May 18, Mr. Bailey saw a female chickadee carry twenty larvæ to its nest. They were apparently all canker-worms but two, which were tent caterpillars. Of this he is certain, for he was within three yards of the nest to which the larvæ were taken. Later, on May 31, he noticed the chickadees feeding their young. It was evident that a large portion of the food consisted of canker-worms. The birds each made a trip to the nest about once in twelve minutes. The male and female came at nearly the same time

and went away together. They went in the direction of an orchard infested by canker-worms. A few of the larvæ were dropped on the ground at the nest and proved, on examination, to be canker-worms.

The crow was also observed feeding on the canker-worms.

On May 22 the birds had nearly all stopped feeding in the neighboring woods and were in the orchards feeding on canker-worms.

Early in June, when the remaining canker-worms had finished their transformations and retired to the ground, several species of birds were again noticed feeding their young on the tent and other hairy caterpillars. Of these, three species (both cuckoos and the Baltimore oriole) seemed to be the most useful. On May 17, a cuckoo was seen to take eleven caterpillars out of one nest. Mr. Bailey writes: "On May 10, a black-billed cuckoo came into a tree near me at 3 p.m. and sat there until 4.40 p.m., then he went straight to a tent caterpillars' nest. He looked it over for a short time and then commenced eating the caterpillars. He picked twenty-seven caterpillars out of the nest before he stopped. The bird ate them all and did not drop one. Then he went to the tree, in which, I believe, he remained during the night, for on Saturday, the 11th, I found the bird in the same tree, and in almost the same place, at 5 a.m."

The orioles, chickadees and vireos often pecked the caterpillars to pieces and ate portions of them, seemingly feeding to a considerable extent on the internal organs. This being the case, it is quite evident that the stomach contents cannot be depended upon entirely to determine the character of the food of these birds, as no one is expert enough to identify the internal organs of caterpillars with such certainty as to determine the species to which they belong.

The following is a list of the birds seen feeding on the tent caterpillar:

Crow (*Corvus Americanus*), Chickadee (*Parus atricapillus*), Oriole (*Icturus galbula*), Red-eyed Vireo (*Vireo olivaceus*), Yellow-billed Cuckoo (*Coccyzus Americanus*), Black-billed Cuckoo (*Coccyzus erythrophthalmus*), Chipping Sparrow (*Spizella socialis*), Yellow Warbler (*Dendroica æstiva*).

During the month of May an attempt was made to render the place as attractive to birds as possible. The undergrowth, which previous to 1894 had been trimmed out, was afterward allowed to grow, and in 1895 several low thickets had been thus formed. The mulberry-trees were stimulated by judicious trimming, and bore a considerable crop of early fruit which ripened in advance of the cherries, thus drawing the attention of the fruit-eating birds away from the cherries, and serving to attract them to the vicinity of the orchard. Ten nesting boxes were put up for the wrens and bluebirds; but as the bluebirds were very rare this season none came to the orchard. Two families of wrens, however, were reared in the boxes in place of one family last year. Nesting materials—strings, hair and straw—were hung in the trees and scattered about. Several marauding cats were killed, and an attempt was made to keep nest-hunting boys away from the neighborhood as much as possible. Thirty-six nests of birds were discovered in the neighborhood, as follows: Three red-eyed vireos, ten robins, four Baltimore orioles, three cuckoos, five chipping sparrows, three least flycatchers, two redstarts, two yellow warblers, two chickadees, two house wrens.

Of these all but three were destroyed probably by boys, the nests being torn down and the eggs missing. The three which escaped destruction were two wrens' nests which had been built in boxes upon buildings, and a robin's nest in a maple tree within ten feet of a chamber window. This wholesale destruction of nests discouraged several pairs of birds, and they disappeared from the neighborhood. Those remaining built new nests, and after a second or third attempt a few succeeded in rearing young. One nest of orioles escaped the general destruction, and the birds were busy for a long time carrying canker-worms to their young. One of them was noticed to take eleven canker-worms in its beak at one time, and fly with them to the nest. The vireos, warblers, chickadees, cuckoos, orioles and chipping sparrows were particularly active in catching canker-worms, and the English sparrow killed them in considerable numbers.

If the thirty-six pairs of birds whose nests were found had succeeded in raising their young, it is probable that they would have disposed of most of the canker-worms in the neighborhood. Five thousand of these larvæ are sufficient to strip a large apple-tree. One hundred and eight young would have been reared, had each pair of birds raised three. According to Professor Augley's experience, sixty insects per day as food for each bird, both young and old, would be a very low estimate.* Suppose each of these one hundred and eight birds had received its sixty insects per day, there would have been 6,480 caterpillars destroyed daily. The destruction of this number of caterpillars would be enough to save the foliage and fruitage of one apple-tree. In thirty days the foliage of thirty apple-trees could have been saved, or 194,400 canker-worms destroyed. This does not include what the old birds themselves would have eaten.

In these observations, the influence of insect parasites and predaceous insects has not been entirely ignored. Hymenopterous parasites were not seen to be numerous, and as it was a year when canker-worms were on the increase, it is not probable that these parasites would have been a prime force in reducing the numbers of the canker-worms had the birds not been present. Even had they been numerous they would have had little effect in checking the ravages of the canker worm during the present year, as their interest is identical with that of the canker-worm, and they remain in its body until it has finished feeding, allowing it to defoliate the trees before completing their deadly work upon it.

We do not know to what extent such parasites are devoured by birds. This we could not ascertain without shooting the birds, which would have defeated our main object. No parasites of the tent caterpillar or canker-worm were found in the stomachs of the few birds which were examined. It is hardly safe to draw conclusions from observations so limited in their scope, but we may infer from what was observed that the egg-eating birds are of the greatest value to the farmer, as they feed almost entirely on injurious insects and their eggs, and are present all winter when other birds are absent. The summer birds which attack the larvæ are valuable also if they can be so protected and fostered as to become sufficiently numerous to do the work required. It is evident also that a diversity of plants which encourages diversified insect life, and assures an abundance of fruits and seeds, as an attraction to birds, will insure their presence. In this connection, I wish particularly to note the fact that the mulberry-trees, which ripen their berries in June, proved to be a protection to the cultivated cherries, as the fruit-eating birds seemed to prefer them to the cherries, perhaps because they ripen somewhat earlier.

I believe it would be wise for the farmer to plant rows of these trees near his orchard, and it is possible that the early June berry or shad berry (*Amelanchier Canadensis*) might also be useful in this respect. It is a handsome shrub or tree, flowering early in the season, and would be attractive at a time when other trees and shrubs are not in bloom.

At the present time, July 23, 1895, the trees in the orchard appear to be in good condition. They have not suffered from the slight pruning of their foliage which was effected by the few caterpillars and canker-worms which survived. The fruit is well set, and it now remains to be seen whether the birds will have any considerable effect in preventing the ravages of the codling moth. No other orchard in the neighborhood will produce any fruit this season, with one exception. The nearest orchard, situated directly opposite on the estate across the way, has not been ravaged by the canker-worms. This exemption is due principally to the efforts of the owner, who has banded his trees with tarred paper and has used tree ink faithfully and well upon the paper. He has also taken pains to clear the nests of the tent caterpillar from the trees. This orchard, being nearest to the one visited by the chickadees, was also an object of their attention, and this may account somewhat for the reduction of the pests in this place.

The record of these observations, incomplete as it is, is given for what it is worth as a contribution to the literature on this most interesting and important subject.

* 1st Rep. U. S. Ent. Com. 1877, p. 342.

THE ROCKY MOUNTAIN LOCUST AND ITS ALLIES IN CANADA.

By Samuel H. Scudder.

The genus Melanoplus, to which the Rocky Mountain Locust belongs, forms part of a small group of genera first definitely separated a few years ago by Brunner von Wattenwyl under the name of Pezotettiges, but which, for reasons given in a technical memoir now in press, I have preferred to call after the dominant genus just mentioned,—Melanopli.

In the last resort, the Melanopli are separated from their nearest allies only by such an apparently insignificant matter as the number of spines (in itself variable) found on the outer margin of the hind tibiæ; these, save for individual exceptions, often on one side of the body only, are always at least nine in number and rarely exceed fourteen. In the known Canadian species they range from eight to thirteen, but ten or eleven is the almost invariable number.

The Melanopli are an almost exclusively American group comprising more than thirty genera of which only one, Podisma, occurs in the old world. They are primarily divided into two sections, dependent on the shape of the subgenital plate of the males, a division

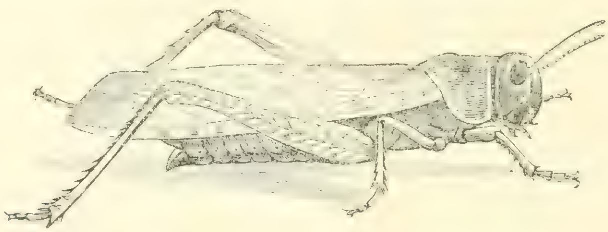


Fig. 32. Locust (magnified.)

which broadly but not exactly separates the tropical or subtropical genera from those of the temperate regions, and leaves an almost equal number of genera in each section. Of the tropical section, as it may be called, but a single genus is known in Canada, Hypochlora; its single species *H. alba* (Dodge) is reported by Brunner as occurring in Manitoba, and this is altogether probable as it ranges along the border in the United States from Minnesota to Montana, but extends south only to Kansas and Colorado. It is a slender, hoary green, long-legged insect with abbreviated tegmina, and is partial to the white sage, *Artemisia ludoviciana.*

Of the temperate section, only three of the genera are actually known to inhabit Canada, though, as we shall see, there is little doubt that others will be found there. One of these is Podisma, formerly known as Pezotettix*, a genus remarkable among the Melanopli for its longitudinal range, which is around the globe north of Lat. 35° N; for its penchant for high altitudes, many of the species occurring only above or at the forest line on high mountains; and for the wide separation of its sternal lobes, though this alone will not separate it from all Melanopli. Moreover its organs of flight are never completely developed and may often be altogether wanting, as may then also, though in none of our American species, the tympanum found on the sides of the first abdominal segment; as this tympanum is regarded as an auditory apparatus, and as the power of producing sound is gone with the loss of the tegmina (against which the femora are scraped,) the absence of the tympanum in some apterous European species would seem to indicate that they had departed the more widely from the original type, and had therefore a longer history behind them.

*See Psyche, vii, 195.

Up to the present time more species of Podisma are known from the old than from the new world; in the latter they are not known over a continuous territory, but over two large areas, one in the east and one in the west. That in the east is inhabited by only two species, one of which is only known from Ithaca, N.Y., at less than 500' above the sea, while the other, the better and long known *Podisma glacialis* (Scudd.,) was first found at the timber line in the white mountains of New Hampshire, and has since been obtained at high elevations 2-4500' above the sea, in Maine on Ktaadn and in the country about the Megalloway, in New Hampshire on Kearsarge in Bartlett, in Massachusetts on Greylock in Berkshire county, and in New York in the Adirondacks; while Mr. James Fletcher and I came across it at the edge of the town of Sudbury in Ontario. It will doubtlesss be found also in Quebec if sought in the proper places; it is not found upon the ground but upon bushes, in the white mountains on the dwarf birch. Bruner also credits it to "British America," but I do not know from what point he received it, and on enquiry I find it was probably a mistake.

The western area from which Podisma occurs has half a dozen species, which range along the rocky mountains from New Mexico to Alberta; all of the species are found on the mountain slopes or in Alpine valleys, and most of them at or above the timber line. A single species only is known to inhabit Canada, *Podisma Oregonensis* (Thom.,) which has been taken at Fort McLeod in Alberta, and is also known from Montana, Idaho and Oregon. It is highly probable that other and possibly new species will be found in the Canadian Rockies; it is especially likely that *Pod. dodgei* (Thom.,) one of the commonest alpine orthoptera in Colorado, and known also from Wyoming and Montana, will occur near timber line in Canada.

A second genus of the section which occurs in Canada is Phœtaliotes, a group founded by me for a single species, the somewhat anomalous insect *Phœtaliotes Nebrascencis* (Thom.,) of which *Pezotettix megacephala* Thom., *Pezotettix autumnalis* Dodge, and *Caloptenus volucris* Dodge, are all synonyms. It has a large, prominent, tumid head, which with a subsellate pronotum gives it a peculiar appearance; it is strikingly dimorphic, full-winged and half-winged, which accounts for a part of the synonymy. In Canada it has been found only in Alberta at Fort McLeod and in Assiniboia at Medicine Hat, but it ranges from here, skirting the eastern slope of the Rocky Mountains, to Texas and even to Central Mexico. I have not seen the long-winged form, volucris, from Canada, but it occurs from Mexico to Montana.

We have left for the last (though in systematic sequence it should have preceded Phœtaliotes) the typical, dominant genus Melanoplus, which contains most of the known Canadian species. This genus is so strikingly dominant as to contain more than one-half of the known Melanopli of the world. In the memoir referred to at the outset, I have described in detail no less than 131 species, all from North America and all but a very few found within the limits of the United States; it finds its principal home in the west, and it is to this genus that the Rocky Mountain Locust and several other minor depredators belong. To handle the genus properly I found it advisable to separate it into twenty-eight groups or series, defined mainly in terms of the male abdominal appendages, which here attain a striking and highly diversified development, and to name the groups after the predominant or older species contained in it. In that order I will present them also in the present account. Many of these species have before been placed under Pezotettix (Podisma) when I and others were accustomed, without careful discrimination, to look upon all the short-winged forms as belonging to that genus and the long-winged ones to Melanoplus. As some species are dimorphic, either fully winged or practically unable to fly from the brevity of the alary organs, that custom had its disadvantages, and a careful study of our entire Melanoplan fauna became a great desideratum, which I trust I may be found to have successfully filled in the paper before referred to.

In the *Glaucipes series*, there is a single species, *Mel. kennicottii* Scudd., a very small full-winged insect, which must be tolerably widespread in Canada, since it has been brought from the Yukon river in Alaska and the Souris river in Assiniboia, and occurs also in Montana.

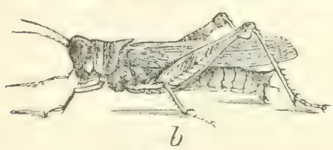
In the *Utahensis series*, *Mel. bruneri* Scudd., a new species of about the size and general appearance of *Mel. femur-rubrum* but the male with a strongly upturned, apically broad subgenital plate occurs in Alberta at Fort McLeod, and extends from there southward to Nebraska and Colorado, and westward to Washington.

But it is in the *Spretus series* that the largest number of Canadian species appear. Most of them are closely allied to *Mel. atlanis.* Here are, first, *Mel. Alaskanus* Scudd., a new species found in Alaska and taken also at Spilmacheen, British Columbia ; next, *Mel. affinis* Brun., another new species found in British Columbia, Washington, Utah and Wyoming ; then, *Mel. bilituratus* (Walk.,) a common species on Vancouver Island, as well as on the mainland in British Columbia, and over the border in Washington, Oregon, Nevada and Montana ; *Mel. atlanis* (Riley,) an extremely abundant insect, occurring throughout the breadth of Canada, from Sable Island, off Nova Scotia, to Vancouver ; it extends northward to the Yukon river in the west, though in the east I have only seen or heard of it as far north as Quebec, Ottawa, Sudbury and Lake Winnipeg ; and finally, *Mel. spretus* (Uhl.,) the Rocky Mountain Locust, the arch-destroyer, whose home is in the high plateaux of the Rocky Mountains and their eastern versant as far north as the Saskatchewan, and which now and again ravages the country to the east by its migrating hordes.

In the *Dawsoni series* there are two Canadian species : *Mel. Dawsoni* (Scudd.,) which occurs in Canada from Manitoba to Alberta, and has two forms, long-winged and short-winged. Only the latter has been found in Canada, and the species ranges to New Mexico. The other Canadian species is *Mel. Gladstoni* Brun., which has been found at Medicine Hat in Assiniboia, and southward to Nebraska. Both these species are small and inconspicuous.

In the *Fasciatus series* are also two Canadian species : *Mel. fasciatus* (Walk.,) widespread in Canada, having been reported or seen by me from Newfoundland, Labrador north of the Straits of Belle Isle, Anticosti, Hudson Bay, Lake of the Woods, Manitoba, Saskatchewan, Assiniboia, Alberta and Alaska. It also occurs in the United States everywhere near the Canadian border, from ocean to ocean, and as far south as New Jersey, Missouri and Colorado. It again is dimorphic, but the wings in the brachypterous form are not very short, and the full-winged form is known only from Michigan. The second species of this group is the only Canadian species not found in the United States, *Mel. borealis* (Fieb.) I have seen it only from the barren grounds of northern Labrador, but it is also reported from Hudson Bay and Greenland. It has slightly abbreviated organs of flight.

In the *Femur-rubrum series* the well known *Mel. femur-rubrum* (DeGeer), Fig. 33 occurs over nearly the whole of Canada, from ocean to ocean, wanting only in some northernmost localities, such as Labrador ; and a second species, *Mel. extremus* (Walk.), ranges from Quebec to the Yukon and is dimorphic, though the organs are half as long as the body in the brachypterous type. The macropterous form seems to affect high altitudes or latitudes. I have seen specimens from the Alpine districts of the White Mountains and from Arctic America, among other places.


b
Fig. 33.

In the *Angustipennis series* the only Canadian species is *Mel. coccineipes* Scudd., a new species of moderately large size, found not uncommonly in Nebraska, Kansas, Colorado and Utah, and of which I took some specimens in company with Mr. Fletcher, at Nepigon, Lake Superior.

Mel. packardii Scudd., is the only Canadian species of the *Packardii series*, but this occurs abundantly from Assiniboia to British Columbia. South of the border it occurs over most of the United States west of the 100th meridian.

In the *Collinus series*, where all the males have forked cerci, there are several Canadian species : *Mel. alpinus* Brun., a very small new species, which ranges from Alberta to British Columbia, and is also known from Idaho ; *Mel. infantilis* Scudd., a still smaller form, originally described from Colorado, but found also in Assiniboia (Medicine Hat),

and Alberta (Fort McLeod); and *Mel. minor* (Scudd.), a tolerably common species in the United States from Maine to the Rocky Mountains, and which was long ago sent from Red River, Manitoba, by Robert Kennicott and Donald Gunn.

Finally, in the *Bivittatus series*, where the species are large (the largest of those found in Canada), we find *Mel. femoratus* (Burm.,) which ranges from Nova Scotia to British Columbia, and extends as far north as Hudson Bay. In the United States it extends southward nearly to the Ohio, and on the Atlantic coast even to North Carolina, while in the west it is nearly confined to the northern tier of states, though it reaches along the Rockies to Colorado and along the Sierras to northern California. A second species, intimately related to the other, but with parti-colored instead of clear red hind tibiæ, *Mel. bivittatus* (Say), is a more southern form, but it occurs with the first in many places, and, in Canada, accompanies it from British Columbia to Manitoba, but not eastward.

It thus appears that ten of the twenty-eight series found in the genus Melanoplus occur in Canada, though but twenty species, or less than one-sixth of the known forms, are included in the list. The list is remarkable for three things: 1, the range of structural diversity as indicated by the number of series represented; 2, the total absence of all species with excessively abbreviated tegmina (*i.e.* only as long or scarcely longer than the pronotum), such as would formerly have been placed unquestioned in Pezotettix, the single one of the known Canadian Melanopli with such tegmina being a true Podisma; 3, that it includes three of the only four well marked cases of wing-dimorphism in the genus Melanoplus. It is true that both the dimorphic forms have not been found in Canada, but that is in all probability a mere accident, collections from Canada being much rarer. The dimorphism is probably co-extensive or nearly so with the species.

But it should not be concluded that the above list actually offers a fair idea of the true Melanoplan fauna of Canada. Canada is so little explored from a natural history standpoint, especially in its western portions where, in the United States, Melanopli are so very strikingly diversified, and so many additional forms have been found next the Canadian border, that we must believe that many of them surpass it and are not now known as Canadian, simply from the little attention paid in Canada to this order of insects. We propose, therefore, to conclude this account by a brief review of such Melanopli as may be looked for with some confidence; we shall discover the probability of a much more varied and numerous series, for the number of genera and species will both be doubled, and the "series" of the genus Melanoplus represented raised from ten to seventeen. All the additional genera, however, belong to the temperate section.

In the first place we may cite Hesperotettix as a probable inhabitant, since *Hesp. pratensis* Scudd., is widely diffused along the northern margin of the United States, from Minnesota to Washington, being recorded in my paper from these two States and all the intervening ones.

Then there is the genus Bradynotes, containing peculiarly broad-chested, robust forms with mere pads for tegmina, all the species of which are confined, so far as known, to the extreme northwest of the United States,—Washington, Oregon, Northern California and Idaho, with Nevada, Montana and Wyoming. No less than four species are found in Washington and two others in Idaho, besides one confined to California, so that it seems altogether probable that one or more of them may be found in British Columbia, if indeed this district do not prove to have its peculiar species.

The genus Œdaleonotus, founded by me on the species I formerly described as *Pezotettix enigma*, a clumsy bodied insect with tumid prozona and stout femora, and strikingly dimorphic in its tegmina, ranges on the Pacific coast from Southern California to Northern Washington where it is abundant, and it may almost surely be looked for in British Columbia.

Another new genus, Asemoplus, created for the reception of Bruner's *Bradynotes Montanus*, a relatively slender form, likewise with lobiform tegmina, has been found hitherto only in Montana and Washington and not further south, so that it probably ranges northward across the boundary.

To turn to the genera known to be represented in Canada, we have already mentioned the probability that *Podisma dodgei* (Thom.,) would occur in the Canadian Rockies; and it is by no means improbable that new species of this genus will also be found.

But for the bulk of the suspects we must naturally turn to the genus Melanoplus. Here, in the *Flabellifer series*, we have *Mel. occidentalis* (Thom.,) known from Minnesota, North Dakota, Wyoming and Montana; and *Mel. flabellifer* Scudd., occurring in Wyoming, Montana and Idaho.

In the *Spretus series*, *Mel. intermedius* Brun, occurs abundantly in Wyoming, Montana, Idaho and Washington, and is, therefore, likely to occur in Alberta and British Columbia.

The *Indigens series* is composed of a single and new species, *Mel. indigens*, which comes from Idaho and may reasonably be looked for a little further north.

The *Mancus series* is another group not yet discovered in Canada, but which may be looked for, as two species, *Mel. Artemisiæ* (Brun.,) and *Mel. mancus* (Smith) are found on its confines: the former in the west on sage brush in Idaho; the latter in the east in Maine and New Hampshire.

In the *Dawsoni series*, an additional species may be looked for, viz: *Mel. militaris* Scudd., which occurs in Idaho.

Several species also of the *Rusticus series*, a group not yet recognized in Canada, probably occur therein: *Mel. Montanus* (Thom.,) found in Montana, *Mel. Washingtonianus* (Brun.,) known now only in Washington, and *Mel. altitudinum* (Scudd.,) which occurs at high elevations in Wyoming, South Dakota and Montana.

Of the *Borckii series*, *Mel. borckii* (Stal.,) is found in Washington, Idaho and Montana.

So, too, in the *Fasciatus series*, *Mel. saltator* (Scudd.,) occurs in the same States and in Wyoming, and may confidently be expected to extend across the border.

The *Alleni series* contains but two species, one of which, *Mel. Alleni* (Scudd.,) occurs in Iowa and Dakota.

One of the representatives of the *Cinereus series*, *Mel. cinereus* (Scudd.,) is of a very wide range, and is known from Washington, Idaho and Wyoming in places very similar to those abundant over the border in the sage-brush district.

Finally the *Collinus series* has probably other representatives in Canada, since *Mel. luridus* (Dodge) occurs abundantly in Washington, Montana, Dakota and Wyoming, and *Mel. collinus* (Scudd.,) is found in equal numbers in Maine and New Hampshire.

A considerable number of these species have tegmina no longer than the pronotum, so that should eventually all of them be found in Canada, what has before been said on this point regarding Canadian species would need to be materially modified. But in any event it seems plain that the Canadian fauna will prove much richer in species and genera than we now know it to be.

It should be added that many of the species mentioned above are as yet unpublished and are not always so specified; descriptions of all are in press.

SEVENTH ANNUAL MEETING OF THE ASSOCIATION OF ECONOMIC ENTOMOLOGISTS.*

The Association met in room 4, High School building, Springfield, Mass., August 27th, 1895. The following officers and members were present:

President John B. Smith, New Brunswick, N. J.; Vice-President, C. H. Fernald, Amherst, Mass.; Secretary, C. L. Marlatt, Washington, D. C.; R. A. Cooley, Amherst, Mass.; G. C. Davis, Agricultural College, Mich.; E. H. Forbush, Malden, Mass.; L. O. Howard, Washington, D. C.; A. H. Kirkland, Malden, Mass; J. A. Lintner, Albany, N. Y.; C. V. Riley, Washington, D. C.; P. H. Rolfs, Lake City, Fla; F. A. Sirrine, Jamaica, N.Y.; E. B. Southwick, Central Park, New York City; F. M. Webster, Wooster, Ohio; C. M. Weed, Durham, N. H.

There were also in attendance upon the meetings members of other scientific associations and entomologistis not members of the Association, among the latter Mr. George Dimmock and Professor Macloskie. The attendance at the different meetings ranged from 20 to 40.

The Association was called to order by the President and reports from officers listened to. The amendment to the constitution proposed by Mr. Summers, November 13th, 1890, but not afterwards taken up, was adopted. It reads as follows:

SEC. 3. The membership shall be confined to workers in economic entomology. All economic entomologists employed by the General or State governments, or by the State experiment stations, or by any agricultural or horticultural association, and all teachers of economic entomology in educational institutes, may become members of the Association by transmitting the proper credentials to the Secretary and by authorizing him to sign their names to this constitution. Other persons engaged in practical work in economic entomology may be elected by a two-thirds vote of the members present at any regular meeting of the Association. Members residing out of the United States or Canada shall be designated foreign members. Foreign members shall not be entitled to hold office or to vote.

The following persons were elected active members of the Association:

Mr. W. Hague Harrington, Ottawa, Canada; Mr. R. E. Palmer, inspector of fruit pests, British Columbia. Proposed by Mr. Fletcher.

Mr. W. S. Bullard, Bridgeport, Conn.; Mr. John Gifford, State forestry agent, Mays Landing, N.J. Proposed by Mr. Howard.

Mr. E. A. Schwarz, Washington, D.C. Proposed by Mr. Marlatt.

Mr. E. H. Forbush, Malden, Mass.; Mr. A. H. Kirkland, Malden, Mass.; Mr. R. A. Cooley, Amherst, Mass. Proposed by Professor Fernald.

Mr. F. W. Urich, honorable secretary Victoria Institute, Trinidad, and Trinidad Field Naturalists' Club.

The annual address of the President, John B Smith, was entitled "Entomological Notes and Problems." He drew attention to the fact "that differences in results obtained by farmers do not always argue ignorance or carelessness, and that insects or insecticides may vary, either in resisting power or in effectiveness, in different localities, and that we must not hastily conclude that what answers in California will be equally effective in New Jersey, nor that the conclusions based upon the most careful experiments made in New York can be accepted unquestioned in Idaho," and stated, "that there are factors not yet understood by us that should make us cautious in recommending too positively or hastily measures based on results reached in localities different from our own, and on the other hand should make us very chary in condemning work done by a confrere because our results do not agree with his."

"The day of testing insecticides is therefore not so nearly over as has been sometimes thought, and we owe it to our constituent, where his results do not agree with our expectations, to test the matter under his conditions before deciding him incompetent; and it does not need the distance between the Atlantic and Pacific to make a difference in condition. Results obtained annually by dozens of farmers in New Jersey seem absolutely

*Through the kindness of Mr. L. O. Howard, Entomologist of the Department of Agriculture, Washington, D.C., we are enabled to give the following account of this interesting meeting.

unobtainable by most careful experiments made in New York ; while I have this season proved, much to my dissatisfaction, that the reverse may be equally true, for I can not secure the results in actual practice with bisulphide of carbon against cabbage maggots which Mr. Slingerland obtained in his experiments. Yet Mr. Slingerland undoubtedly recorded only what he found, and sooner or later the reason for the failure in New Jersey will be discovered. Each worker must therefore study his own field most carefully."

He next took up the question of how to control the publication of entomological matter in newspapers in order to prevent the dissemination of erroneous statements, and mentioned the difficulties that he encountered in his efforts to do so. He then referred to the impossibility of keeping track of everything that is published on economic entomology, referring not only to bulletins and reports, but also to the articles published in agricultural journals and newspapers, and asked whether there might not be some feasible way of interchanging among the members of the Association, records of all articles containing original or useful information. He also suggested that some arrangement should be adopted for the interchange amongst the members of specimens of injurious insects and their work, and also the formation of a central collection of economic entomology.

He then dealt with the subject of legislation against insect pests and referred to the difficulty of arousing public opinion sufficiently in order to secure action. He also dwelt upon the importance of having some kind of inspection of trees and shrubs grown in nurseries before they were sent broadcast over the country.

" Perhaps I have spoken enough of problems and of difficulties—he went on to say—and should mention some of the accomplishments, some problems solved. Unfortunately there are none. Progress there has been in many directions, and of the most encouraging kind, but no striking successes, no epoch-making discoveries. We have not yet succeeded, for instance, in dealing more satisfactorily with grasshoppers ; but it is decided progress to learn that in a single State several hundred 'hopper-dozers' are in use under the direction of the entomologist and that the State has realized the importance and necessity of this kind of work. Our good friend and fellow-member, Dr. Otto Lugger, has certainly succeeded in securing respect for his profession and a reduction of his preachings to practice.

" Chinch bug work continues in a number of States ; but we are not much nearer a final decision concerning the actual value of the Sporotrichum as a destructive agent. The chief objection to it seems to be that it requires the intelligent co-operation of the weather to secure the best results, and the weather is notoriously unreliable except in so far that you may count with reasonable certainty that it will not be as you want it.

" In this very State of Massachusetts we have a striking example of a destructive increase of an imported pest—the gypsy moth—and an interesting experiment in the direction of its destruction by the State. There are to be two papers on this subject, I am informed, and there will probably be a discussion on the principles concerned in the matter of dealing with imported pests. But I will take the liberty of offering just a few remarks here, not on the methods employed, but on the general principles involved. Under our scheme of government the individual States jealously reserve to themselves all matters of internal interest, and the Federal authorities are excluded from all save a fairly well-determined class of subjects. But no State seems to owe any duty to its neighbors, and Connecticut cannot force Massachusetts to protect it from an invasion by any Massachusetts pest, nor can it claim damages for any resulting injury. Each State is thrown upon its own resources for the protection of its own citizens. Connecticut took no steps to restrain the spread of the pear midge, and New York and New Jersey, though they are sufferers by the neglect, can make no complaint ; but these States have in turn left the matter to individual effort, and Pennsylvania and Delaware, when their turn comes, will most likely adopt the same policy of non-interference. There is nothing, in other words, to prevent the spread of this insect over the entire United States except the limitations imposed by nature itself. Just what they are remains to be seen.

" Massachusetts owes no duty to other States to protect them from the gypsy moth. She owes a duty to her citizens only, to the extent that her citizens in a legal way them-

selves determine by their own representatives. If in protecting themselves they protect their neighbors also, they deserve no credit for this result and have no claim for assistance. Yet it is a very grave question whether Massachusetts is not entitled to the assistance of her neighbors or of the general government in her efforts to exterminate this insect. I am offering no opinion as to the possibility of extermination—I have expressed myself both ways and cannot find another—but is not this really a matter of national importance, and should not the national government have certain duties or powers in cases of this kind?

"It is said that nothing is wholly bad, and so I find it possible to see a good feature even in the continued spread and increased injury caused by such imported pests as the elm leaf-beetle. I believe that this creature has done more to arouse public interest in economic entomology than any other single factor for many years past. Our cities are the centres of public interest nowadays, and our metropolitan press voices its expression. Insect injury to agricultural products rarely excites more than a passing curiosity, but the depredations of shade-tree insects in streets, parks, or near-by country roads, and on the grounds surrounding country houses attract attention immediately and produce loud and continuous complaints. The press is interested, and through it the public, while those most vitally affected, the owners of fine shade trees, are induced to examine into a question which they would otherwise have considered as of not the least practical interest. It is from this point of view that I welcome the recent great spread and increased injury from this elm leaf-beetle. City and town authorities and village improvement societies have taken up the matter, have inquired into it, and have even made some more or less successful experiments; and these, if continued, as they must be from the nature of the case, will produce an increased interest in and appreciation of economic entomology. Insecticide machinery and a knowledge of the application of remedial measures against the more common pests will be required of each park department and its employees, and the entomologist will be as important an officer as the landscape gardener. * * *

"I have noted an increasing tendency of late to attempt the control of insect pests by methods of cultivation or farm practice, and this, in my opinion, is much to be commended. There are periods in the life histories of many insects when they can be easily reached if we only know how, and where resort to some simple bit of field practice may prevent injury. A good example of this is seen in the practice of cutting close to the surface all shoots of blackberry about June 20 to prevent injury from the *Agrilus ruficollis.* All the eggs have been laid at that time, and the new shoots will be exempt, of course, while the larvæ cannot develop in those that have been cut down and will die. The whole matter seems so simple now, and yet it is less than two years ago that this was practiced almost simultaneously in New Jersey and Ohio.

"Preventing injury from the larvæ of *Melittia ceto* in late squashes by planting summer varieties upon which the eggs are laid and in which the larvæ are afterwards destroyed is another method which has been worth many hundreds of dollars to farmers on Long Island and in New Jersey.

But there is yet much to be done in this direction, and I am convinced that in the future "circumvention" will be practised in many cases where we now use poison. Farm practice, using this term in its widest sense to include the mechanical treatment of land, selection of fertilizers, date of planting and harvesting, rotation of crops, etc., will in time give us control of many injurious species which at present seem beyond our reach. It must be our aim to ascertain as far as possible the circumstances least favorable to the development and maintenance of the troublesome species, and then our attempt must be to produce just those conditions.

"We should, I think, whenever possible, lay great stress upon the importance of destroying crop remnants when they are no longer needed. For instance, cucurbit vines are usually left on the ground after all the crop is off, affording abundant opportunities for the maturing of *Anasa tristis*, the melon lice, and other pests. Removing them when no longer needed and destroying will save much trouble during the year following. Systematically burning potato vines as soon as the crop is harvested will prevent all

danger of injury from the potato-stalk weevil (*Trichobaris 3-notata*), and I might cite many other cases were it necessary. We should also set out the advantages of winter work against many kinds of insects in orchard, vineyard and garden, and the desirability of destroying by fire everything that comes under the head of rubbish. Especially against certain kinds of hemiptera this sort of work would prove effective, and fire, judiciously used, can be made a valuable friend. So, much of the pruning should be done at this season, where the character of the plant warrants it, and if the cuttings be burnt many ova of insects will be destroyed. But I am telling you old facts which you do not care to hear. My purpose was not to offer them as information, but to urge their more forcible presentation to the farmer, and to indicate that in my opinion the future development of our dealings with insects will be along this line. * * *

"On the whole, I may repeat, we have rather cause for congratulation than otherwise. Our favorite branch of scientific investigation has made continuous and healthy progress; we have firmly established the reason for our existence and have impressed the general public with a dawning of appreciation for the work we are doing. Our session here will, I doubt not, improve our standing, and will at all events be profitable to those taking part."

Professor Fernald discussed interstate entomological problems with particular reference to the gypsy moth and the attempts to get the work against this insect undertaken by the General Government. He referred also to the difficulties arising from the conflict of interests of different States.

The first paper on the list, "Notes on Insecticides," was read by Mr. C. L. Marlatt, in which he described at length a series of experiments that he had made in order to thoroughly test the various apparatus that had been designed for spraying with kerosene oil and water, the results of which were not entirely satisfactory. He then treated of various insecticides, viz , soaps, arsenate of lead, cyanide of potassium and arsenite of copper.

AFTERNOON SESSION—AUGUST 27, 1895.

A paper by Mr. H. E. Weed on "Some Experiments with the Knapsack Kerosene Attachment," was read in his absence by Mr. Davis. In it the writer set forth the advantages that are claimed for the use of this mechanical mixture of kerosene and water over the familiar kerosene emulsion. It was followed by a paper by Mr. Clarence M. Weed on "A Modification of the Kerosene Knapsack Sprayer," in which he reported a series of tests of the knapsack sprayer with kerosene attachment, showing that the principal machine now on the market is unreliable in its present form. The chief source of error appears to be due to the continual differences of level in the kerosene and water tanks. To avoid this a kerosene attachment had been made at the New Hampshire Experiment Station, and was exhibited, of the same height as the water reservoir and holding one-tenth as much. A stopcock with a single hole one thirty-second of an inch in diameter connected the kerosene reservoir with the pump. By this arrangement a fairly constant spray having nine per cent. of kerosene in it was obtained. The opinion was expressed that to get successful results we must abandon the idea of having a large range of variation in one combination of reservoirs—*i e.*, in expecting to get either a five per cent. or a thirty per cent. emulsion by turning a stopcock at a less or greater angle. The author believed that the kerosene sprayer was capable of great improvements along the lines indicated, and thought it too great an advance in methods of insect warfare to be lightly abandoned.

The following communication on "Spraying Without a Pump," by Mr. J. M. Aldrich, was in the form of a letter to the Secretary, accompanying a working sample of the apparatus. The apparatus itself and the manner of working it were described by the

Secretary with the aid of blackboard illustrations. The following is an abstract of the letter :—The spraying device which was suggested by the author to the association last year was again presented to call attention to two changes in the machine from the first idea. First, it is necessary that the stream from the hydrant enter the lance within rather than beyond the entering point of the insecticide ; second, the Nixon nozzle is entirely inapplicable to this form of apparatus, for the reason that it chokes the flow so as to destroy the suction in the insecticide tube. No nozzle has yet been devised free from this objection, except a plain deflector tip. The author is aware that a deflector does not give so good a spray as can be obtained in other ways, and hopes yet to overcome this objection.

The spraying device consists of a sort of lance, forked at the base. One fork connects with a hose to a hydrant or water supply under pressure, and the other with a tube leading into the vessel containing the insecticide. Both forks are provided with stopcocks. The suction caused by the passage of the water through the lance induces a flow through the fork and hose leading from the insecticide.

To use the apparatus, attach to an ordinary lawn hose by the large coupling. Turn on the city water, and it will be at once perceived that there is a strong suction through the small or insecticide tube. Put the end of this in a pail of water or kerosene, and, in the case of the apparatus experimented with, sixteen per cent. of the total discharge comes through it, the stopcock being wide open. By partly turning off the stopcock the proportion of kerosene can be reduced at pleasure, and the percentage may be indicat d by graduations on the back part of the stopcock.

For Paris green, make up a pailful at the rate of one pound to twenty-five gallons of water, and when drawn through the machine it will be diluted at the eight per cent. kerosene gauge mark to one pound to 150 gallons and thoroughly mixed.

The device was experimented with by the inventor with a water-pressure of seventy-five pounds, which was inferred to be an average for city water.

No claim to novelty for this device was made except in the application. The principle is the same as that in the "jet pump" used for draining out barges, cellars, etc.

If the instrument deserves any name, it is suggested that it be called the Idaho jet sprayer.

Discussion of the foregoing papers followed. Mr. Southwick had canvassed the question of spraying from hydrants in his work in Central Park, New York, but had found it impracticable on account of the insufficient pressure of the water and the small number of hydrants. He said he was devising a steam pump which he hoped would give greater satisfaction than any apparatus hitherto used.

Mr. Davis suggested that any apparatus dependent on a constant water supply, as of hydrants, would be more feasible in the West in connection with irrigation plants.

Mr. Howard remarked that a stream produced by a pressure of seventy-five pounds to the square inch, mentioned by Mr. Aldrich as obtained from his hydrants, was quite sufficient to kill insects, with the exception of scales, without the addition of oil.

Mr Lintner asked if the oil and water mixture referred to in the various apparatus described in the papers could be properly considered an emulsion.

Mr. Marlatt said that an oil emulsion was merely the breaking up of the oil into minute globules in the emulsifying agent, and that on this basis the water and oil mixture, as long as permanent, was as properly an emulsion as the kerosene and milk mixture. He referred also to the fact that emulsions are often made with solid ingredients, as powdered lime.

Mr. Southwick referred to a nozzle which had lately come under his observation, which effects the mixture of the insecticide element with water at the moment of spraying. He had not yet experimented with it.

Mr. Marlatt said that from the description Mr. Southwick undoubtedly had in mind the Gillmore nozzle (to which Mr. Southwick assented), and said that Mr. Gillmore was at the Department, and some very careful tests were made with this nozzle with various insecticide agents. The character of the nozzle and the practical objections to its use were then pointed out.

Mr. Forbush said he knew of a similar principle at one time employed by a fire apparatus company to mix a fire extinguisher with water at the moment of spraying.

Mr. Smith said it was very encouraging to see such decided interest taken in the manufacture and improvement of machinery for the application of insecticide mixtures. He was of the opinion that the origination of new devices and the work of perfecting old ones or overcoming mechanical difficulties may be safely left to manufacturers, whom he had always found very ready to adopt suggestions in the matter of the betterment of apparatus. In this connection he referred also to the adoption by the Climax Pump Company of an improvement in the kerosene knapsack sprayer suggested by Mr. Goff. His experience with the improved knapsack sprayer, he said, corresponded very closely with that detailed by Mr. Marlatt.

Mr. Marlatt, referring again to the device suggested by Mr. C. M. Weed, pointed out that while the arrangement of the kerosene and oil reservoirs suggested by this author would probably obviate several of the difficulties, still an important objection, arising from the oil escaping into the water chamber during the action of the pump or immediately thereafter, was not corrected by this means, although possibly rectified by the combination suggested by Mr. Goff in a communication in Garden and Forest of April 10, 1895.

Dr. John B. Smith read the following paper :

"Raupenleim" and "Dendrolene."

"Raupenleim" and "dendrolene" are both crude petroleum products of a butter-like consistency at ordinary temperatures and becoming only slightly softer at high temperatures. The raupenleim is a German product, very dark in colour, with a tarry odour and probably mixed with some tar preparation. The American product is brown in colour, almost without odour, and without foreign admixture to disguise its character or give it a specific smell. Raupenleim is largely used in Germany to protect trees from the attacks of certain insects and to prevent their being injured by stock or deer during the winter. The materials were tested comparatively for the purpose of preventing borers from attacking fruit trees, and if possible to prevent their issuance when already under the bark. Both materials can be readily applied with a paddle or trowel and distributed by means of a stiff brush so as to make a tolerably even coating. Experiments showed that it did not injure even young shoots where applied to the bark only ; but where buds or growing tissue were covered it killed the buds and shoots by choking the stomata. A young tree set out in 1894 was covered from the surface of the ground to the buds without detracting from its vigour during the balance of the season. It was applied upon an orchard of pear trees infested by the sinuate pear borer and both materials prevented oviposition. The raupenleim absolutely prevented the issuance of all the beetles maturing under the bark. The dendrolene did the same where thoroughly applied. The raupenleim has a tendency to harden on the surface. This is a good thing where it is intended to prevent beetles from issuing from the trees, but a bad thing where it is intended to prevent insects from crawling up the trunk. The dendrolene becomes very soft at high temperatures without running. This prevents insects from crossing it; but where it is applied thin it does not always form a barrier to insects emerging through the bark. Its application is recommended as against the fruit bark-beetle (*Scolytus rugulosus*), which can not emerge through it when already in the tree, and can not enter the bark protected by a coating. It was also tested against peach borers, and both materials proved effective.

It was stated by the grower conducting the experiments that the dendrolene killed the borers that were in the tree when it was applied, while the raupenleim did not. This fact may have been accidental and is not to be expected under ordinary conditions. The material is recommended for application to fruit trees to prevent attacks of round and flat-headed borers, and also wherever it is desirable to prevent insects from ascending or descending the trunk. A broad band, put on thickly, is recommended against the codling moth, and, in cities, against the white-marked tussock moth and the bag worm. It is suggested that applied on trunks on which insects like the pear psylla hibernate it will destroy these insects by preventing their coming out in the spring.

The cost of the raupenleim, free on board in New York city is, for twenty five pounds, $3.75 ; fifty pounds, $6.75 ; one hundred pounds, $12.75 ; barrel, from 250 to 275 pounds net, about $25. Dendrolene is supplied free on board at six cents a pound in New Brunswick, N. J., in lots of twenty-five to fifty pounds, and at 5½ cents in lots of one hundred pounds and over. The material can be washed from the trunks of the trees if desired by a strong potash mixture, say one pound of potash in a gallon of water. As the substance is a mineral product, it does not become rancid.

In answer to a question as to the composition of the lime, Dr. Smith stated that it was chiefly, if not entirely, crude mineral oil.

Mr. Southwick read extracts from a letter from agents for an imported insect lime, which were very extravagant in statement.

Mr. Fernald said he had experimented with the lime against the spring cankerworm, in conjunction with other experiments with printer's ink, the latter applied on paper bands, and banding the trees also with cotton, two or more bands being placed on the same trunk. Very few worms passed over the cotton bands, considerable numbers over the ink bands and a few over the lime. The larvæ chiefly effected their passage over the latter on cool mornings, which indicates that very diverse effects may be expected in different climates. He thought that of the three substances experimented with the imported or raupenleim gave the best results.

Mr. Howard asked what period of the year was included in the five months during which the lime was on certain trees.

Mr. Smith replied that they were the five months immediately preceding the middle of July.

Mr. Lintner suggested that the lime be so thinned down that it could be sprayed, to facilitate application.

Mr. Smith stated that this thinning would be especially desirable for work against scale insects, but that even when considerably thinned it could not be sprayed through an ordinary spraying nozzle.

Mr. Forbush said he had not his notes with him and therefore could not give in detail his experience with lime, which had been very extensive. He had used the raupenleim and an American material, Menzel's brand. He had found considerable difference in imported material obtained in different years. Sometimes it had proved very unsatisfactory and he had discontinued its use for other methods which he deemed more advisable for his work. He said that some insects can cross the lime, but when it is warm, and especially on sunny days, it is a nearly perfect barrier. On cold days, and particularly in stormy, rainy weather, insects can pass it with comparative ease. On smooth bark it will run somewhat, and will also crack or break, especially on rough-barked trees. German authors, he stated, claim that no injury results to the trees from its application, and his own experience was confirmatory of this. The only injury he had noticed came from the scraping prior to the application of the lime or injury from the lime as a result from such scraping of the bark. On dusty streets the lime soon crusts over and may be crossed by insects, and pine needles adhering to it produce a similar result. It is claimed by some that limed trees are not frequented by birds, but this idea was not confirmed by his own experience. He had used various machines and various devices had been constructed by the commission for the application of the

lime. The necessity in cities or public parks of applying the lime at considerable heights on the trunks to prevent contact with it on the part of passers-by rendered many machines for its application impracticable for his purpose, and he had been compelled to employ chiefly paddles and trowels. European machines were found to be crude and somewhat unsatisfactory. He said that in Europe the lime was employed also as a coating for egg masses to prevent the escape of the larvæ The objection to this was that such egg masses were very apt to be broken open by squirrels and the larvæ thus enabled to escape at the proper time. He thought lime would be of value, particularly against the canker-worm. He had found in certain instances that after lime had been exposed on trees during summer and winter the following spring it was still of a consistency to be of service.

Mr. Smith said that the dendrolene referred to in his paper is entirely without odour, whereas the European lime smells very strongly of tar. He was of the opinion that this odour was given to the European product to conceal its true composition.

Mr. Davis had tried wool bands with parallel experiments with raupenleim against canker-worms, and found the latter successful in every instance; but this could not be said of the wool bands. He had found lime impracticable against cut-worms, many of them crawling over it in the cool of the evening; and it had not proved entirely satisfactory against the peach borer, as the borers frequently emerged in spite of the coating of lime.

Mr. Smith said that this would be very probably the case if the application were made to the peach after the larvæ were in the tree, but that the application would be more successful if used to deter the moth from ovipositing.

Mr. Southwick said that in his experience he had found the tussock moth larvæ so numerous that they had been able to crawl over the lime on account of mere numbers.

Mr. Smith said this would not occur in the case of young larvæ.

Mr. Forbush said larvæ would bridge over any band when very numerous, and that such a result could only be prevented by visiting the bands and collecting at frequent intervals the larvæ accumulated beneath.

Mr. Smith said that the American product referred to in his paper was less affected by extremes of temperature than the European lime. He was convinced that in insect lime we have a valuable means of defence against many insects, but that there was room for considerable improvement at present.

Mr. Forbush said that while he had discontinued it for other reasons, he believed that there were great possibilities in the proper use of insect lime.

Mr. Fernald, referring to the Russian lime, said that all the material probably came originally from Germany.

Mr. Smith stated that the constituent elements of the lime very possibly came from the oil regions of Russia.

Mr. Marlatt said the Department of Agriculture had received samples of this raupenleim, and called attention to the very strong similarity between this substance and ordinary axle grease, both in odour and physical qualities, and suggested that the composition of the lime was probably very similar to that of axle grease. He said that in applications to trees as against scale insects, and wherever applications were more generally made than by mere banding, the after effect on the tree would probably be disastrous, although it might not develop for some months. Experiments with other oils on trees gave a strong probability in this direction.

Mr. Smith said the insect limes would very probably turn out to be material similar to axle grease. The dendrolene referred to by him was a Standard Oil Company's product, and would very likely appear under different names as coming from different houses, although all would obtain their supply from the Standard Oil Company. As applied to old bark, which had no vital function, subsequent injury need not be feared.

Mr. Howard referred to the press reports of the loss by a Kentucky orchardist of a thousand valuable peach trees from the application of linseed oil, with other ingredients, as a preventive to the borer. The recommendation which led to the application was charged to the Department of Agriculture, this charge proving, however, by the man's own admission, to be unfounded.

Mr. Davis remarked that a similar remedy had been recommended by the United States Pomologist to the fruit growers of Michigan.

Mr. Smith called attention to the necessity, in reporting results, of giving adequate explanations, instancing the danger of confusion in the use of the term "emulsion" arising from the different kerosene emulsion formulas used as a case in point.

Mr. Forbush gave further results obtained by the commission in the use of lime against the gypsy moth and against the tent caterpillar, all indicating the value of lime. He also described the method of clearing out underbrush as a means of starving out the larvæ.

Mr. Howard said the starving-out plan was the one principally relied on in the work against the nun moth in Austria. Trees of considerable size were banded with the insect lime to prevent the ascent of the larvæ, and all low-growing vegetation was then absolutely destroyed and the larvæ perished for want of food. He further said that there are certain species of plant lice which descend the trunks of trees in autumn and ascend again in spring, against which bands of lime could be used to advantage. This would be particularly the case with the species common upon the tulip tree.

Mr. Lintner, referring to the difficulty of preparing a good emulsion, suggested the advisability of someone's undertaking the preparation of the emulsion as a merchantable article, spreading its benefits to the general public, who were not sufficiently skilled or equipped to undertake its home manufacture.

Mr. Smith said that some patented insecticides very closely imitated the kerosene emulsion, but were more expensive than their cost of manufacture warranted; but he agreed with Dr. Lintner as to the desirability of having the standard emulsion on sale.

Mr. Howard said that where an appropriation was available the superintendents of parks might make the emulsion and distribute it free of charge, as had been done in New Haven.

Mr. Southwick read a paper entitled "A City Entomologist and Insecticides."

The paper was discussed briefly by Messrs Smith and Howard.

Mr. Smith, discussing the work of Scolytus, stated that they normally attack weakened or unhealthy trees, and that a vigorous tree would require very considerable work by Scolytus to seriously injure it.

Mr. Lintner said he understood from Mr. Davis that the trees were thus diseased and unhealthy.

Mr. Davis replied that some of the trees were thrifty and others lacked vigour.

Mr. Rolfs referred to the great numbers of Scolytus which followed the disastrous frost of last winter in Florida, causing great alarm among fruit growers. He said, however, that the trees attacked were such as were greatly injured by the frost and would probably have died anyway from the effects of the latter, and that the beetles were always present though rarely injuriously abundant.

Mr. Howard said that it is well known that in the absence of sickly trees Scolytus will attack healthy and vigorous trees, and that the present large numbers of Scolytus are therefore a constant menace.

Mr. Smith said he had been informed by Mr. Schwartz that the beetles will enter healthy, vigorous trees, but are unable to successfully propagate in them.

Mr. Lintner said that Professor Peck had found them attacking perfectly healthy spruces.

Mr. Smith, referring to the climbing cut-worms, said that he had been frequently called on to determine for correspondents moths described as having been bred from climbing larvæ. He had received several such from Mr. Slingerland. He questioned if they did not adapt themselves to differing conditions, sometimes assuming the climbing habit, while perhaps normally working on the ground.

Mr. Howard reported that the species *subjuncta* and *scandens* had been repeatedly sent in this year as climbing cut-worms.

Mr. Sirrine asked if all cut-worms did not climb as young larvæ, giving his experience with cabbage cut-worms as sustaining that view.

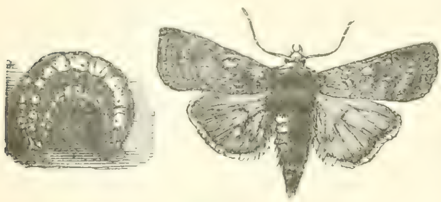


Fig. 34.

Mr. Smith said that this is the habit of *Carneades messoria* Fig. 34, on onions. In this connection he urged the value of personal observation to impress one with the true significance and importance of the working habits of insects. In illustration of this he referred to his having recently witnessed a grasshopper invasion in the west, which had brought to him a realization of the possibilities of this insect to which before he had been a stranger. He said also that the Hessian fly, commented on by Mr. Davis, had proved very much more numerous in New Jersey this year than in years recently passed.

Mr. Lintner said this fly was also very abundant in western New York.

Mr. Howard said this is distinctively a Hessian fly year, and that the division had recently issued a circular to facilitate answering the numerous inquiries received on the subject.

The following paper by Mr. Chittenden, was read by Mr. Sirrine:

Herbivorous Habits of Certain Dermestidæ.

The Dermestidæ, as is well known, feed chiefly upon dried animal substances. Certain species, however, are reported to have injured vegetable material, and a few recorded instances of damage of this character are cited. Until very recently the various species of household Dermestidæ had not been suspected of actually breeding in other than animal substances, but the experiments of the writer indicate that they subsist also on a vegetable diet.

The larva of *Attagenus piceus*, or black carpet beetle, was received in cereals from various sources, and was finally brought to the attention of the writer in such manner as to lead to a suspicion that it might feed, at least occasionally on vegetable substances. Adult insects were confined in a jar of flour and meal, and their progeny were found to thrive upon this material. This species was also found to breed in timothy seed, and incidental mention is made of serious injury to bolting cloth by it in a mill at Georgetown, D. C. A brief review of the history of this insect in America, where it has been known since about 1806, is given, and instances of its reported occurrences in granaries are citied.

Trogoderma tarsale Melsh., a common museum pest, was found to infest flaxseed, castor beans, and cayenne pepper that had been on exhibition in the museum of the United States Department of Agriculture, the larva being reared from the egg deposited in these substances and the adults having been bred from other larvæ feeding on them.

An unknown and evidently recently imported species of Trogoderma was stated to be living in flaxseed, castor beans, and silk worm cocoons with the above-mentioned species, and in red-clover seed. This species is believed to have been introduced at Washington in the silkworm cocoons. It has been taken in New Mexico and will probably be found to have established itself elsewhere in the United States.

Anthrenus verbasci Linn, our most abundant insect cabinet pest, was reported as occurring in "middlings" and spoiled flour, and the fact mentioned that at the time of writing larvæ placed in flour were feeding upon it, from which it was judged that they would in due time reach the adult condition.

In conclusion it is stated that in the case of the Attagenus and Anthrenus, these insects were probably first attracted to granaries by the presence of weevils and other grain insects, and that the graminivorous habit is an acquired one. The presence of Trogoderma in oil seeds and red pepper, however, admits of no other explanation than that of the absence of animal food, and shows a wonderful adaptability to unnatural environment.

Mr. Howard said that the buffalo moth does not occur in Washington, its place being taken by *Attagenus piceus*. He asked for the experience of others as to the former insect to determine its southern extension. *A piceus*, he said, is not so troublesome as the buffalo moth but is yet a serious pest. In answer to a query from Mr. Davis he gave a brief description of the larvæ of the two species.

Mr. Lintner, referring to the popular designation of the insect as the "buffalo moth," said that he had often urged the discontinuance of the use of this misnomer and thought an effort should be made to secure popular acceptance of a more appropriate common name for this species. He thought it not so strange that Dermestidæ fed on vegetable material, since many species having an altogether animal feeding habit in the larval state are vegetable feeders as adults, instancing the feeding of larvæ of various species on woollens and other animal products, the adults of which feed on pollen.

Mr. Fernald discussed the use against these insects of inflammable and explosive insecticides in connection with its bearing on insurance policies and was inclined on this latter account, not to recommend them. He gave the method of controlling the pest followed with success by his wife, as follows : (1) Before bringing flowers into the house thoroughly shake them to dislodge the beetles. (2) Regularly collect and destroy the beetles which emerge and gather on the windows of the house during the months of March and April. (3) Carefully treat the carpets on the upper floors of the house, as the beetles commonly enter through the upper windows, and these carpets act as traps, getting the first and the bulk of the invasion.

Mr. Davis said his wife had been unsuccessful in the use of similar remedies.

Mr. Rolfs said that the work of the carpet beetle was much worse in the South than in the North, but he did not know the species. He used carbon bisulphide or cyanide gas, preferring the latter. If used with caution he thought neither of these substances dangerous, and their use was especially desirable in connection with herbariums.

Mr. Lintner said that he ordinarily recommended kerosene, which he thought more suitable than gasoline. Before laying new carpets all the grooves should be carefully filled with cement or plaster, and the carpets should be left loose at the borders to facilitate frequent investigation. The use of tarred paper was also advisable. He had found the following trap method valuable ; Remove all woollens from rooms or closets and scatter about them bits of red flannel, which is a very attractive bait for the Anthrenus. The beetles thus attracted are afterwards collected and destroyed. Referring to Mr. Fernald's statement regarding the method of entrance of the beetles from flowers out of doors, he said that this is a common experience and that they commonly enter houses through the upper windows and appear first in the carpets of the upper rooms, thus making their reappearance after having been exterminated.

Mr. Fernald discussed the subjects of the relation of colour in woollens or carpets to infestation by the buffalo moth, and said that it had been carefully investigated by his former assistant, Mr. Lounsbury, as to the attractiveness both of particular colours and different dyes to the beetles. The information was sought from various sources, including factories for the manufacture of carpets and rugs. The conclusion arrived at was that colour is not an important factor—at least the beetles do not confine their attacks to

particular colours, though showing a preference for the greens. He thought it more likely that the preference exhibited by the beetles in certain cases was due rather to the mordant employed.

Mr. Howard said that the best remedy and the one which he now always advised, was to abandon the use of carpets altogether.

Mr. Smith had used the method suggested by Mr. Davis and had also employed gasoline. He had not found anything in insurance policies against the use of this or like substances in small quantities, but he was always careful to urge the greatest caution in the use of inflammable substances. He gave, by request, certain experiences which he had had with the use of bisulphide of carbon in the National Museum, a rather serious explosion having in one instance occurred from the ignition of this substance by the heat from a steam radiator, while there was another equally startling case of the ignition of the substance in a large box, resulting from a spark having been struck off from a nail in fastening down the lid of the box in which the bisulphide had been placed. In the latter case the box exploded and the negro laborer was either thrown a distance of some feet or had leaped a considerable length under the excitement of the moment.

Mr. Howard asked Mr. Taylor, a visitor present, who is engaged in the manufacture of bisulphide of carbon, if he knew of any cases of accident from the use of this substance.

Mr. Taylor replied that he knew of but one case of serious results, and that was where an explosion had resulted from a stroke of lightning. He was inclined to think that with ordinary precautions the danger was trifling. He said that the substance will ignite at 220° F.

Mr. Smith said that the radiator referred to by him was not nearly so hot as that.

WEDNESDAY MORNING—AUGUST 28th, 1895.

Mr. L. O. Howard read a very interesting paper on "Some Shade-tree Insects of Springfield and other New England Cities," in which he treated especially of the elm-leaf beetle (*Galerucella luteola*), and the Woolly Maple leaf Louse (*Pseudococcus aceris*), and traced their progress throughout the region referred to.

Mr. C. L. Marlatt followed with a paper on "The Elm-leaf Beetle in Washington," in which he described the methods pursued by the Division of Entomology to protect a grove of elm trees in the grounds of the Department of Agriculture from the ravages of this destructive insect.

Another paper descriptive of the history and injuries wrought by the same insect at Albany, N.Y., was read by Mr. J. A. Lintner, State Entomologist.

A long and interesting discussion followed in which most of the members present took part.

At the afternoon session Professor Fernald gave an extended account of the operations of the Gypsy Moth Commission in Massachusetts. (See 25th Annual Report, 1894, page 67, for a description of this insect, and the methods adopted to keep it in check.) In response to a request Mr. Kirkland, assistant entomologist to the Gypsy Moth Commission, gave a verbal report on the more recent experiments with insecticides conducted by the Commission. He said that no success had been had with insecticides until the arsenate of lead had been devised, and even this, at the rate of ten pounds to 150 gallons of water, effected the destruction of only about fifty per cent. of the larvæ. He described his examination of the alimentary canal of the larvæ, with a view to determining the probable action of the juices contained in various parts of the canal on insecticide substances. He had found the juices strongly alkaline, and of the substances which seemed most likely to be acted upon by an alkaline liquid he had considered the cyanides of different metals to be the most promising. The cyanides of lead, antimony, copper, zinc,

iron, manganese, mercury, etc., were considered. The cyanides of antimony and copper, on theoretical grounds, seemed to promise best. The cyanide of antimony was totally without effect at the rate of 10 pounds to 150 gallons of water. Cyanide of copper was fairly effective, but too expensive for practical employment, three pounds to 150 gallons being with this substance equivalent to one pound of Paris green to 150 gallons of water, or three or four pounds of arsenate of lead to 100 gallons. Even where no practical results seem to have been obtained, as in the above series of experiments, he pointed out the value of the negative results; in that the very fact that the merits of these substances valuable for insecticides is better understood and limited. In connection with the various experiments with insecticides he had occasion repeatedly to emphasize the extreme vitality of the gypsy moth larva and its immunity to the action of poisons.

Mr. Riley discussed the gypsy moth question at considerable length. He said he had always been much interested in the gypsy moth work, and referred to the orginal conference called by the State Board of Agriculture of Massachusetts, giving an account of this meeting, and of the suggestions made by himself and others as to means of controlling the insect. These suggestions were necessarily based on experiences with our well known common insects having somewhat similar habits, and had no basis in any actual experience with the insect under discussion. He had recommended and believed that the use of the arsenites is one of the most practical and effective means of control. There can now be no doubt, however, that this insect is an exceptional one, and probably can not be controlled by means which are quite effective against other insects, enemies of our trees, having similar habits. Emphasizing the great damage which may be done by this insect, he was convinced that its control and destruction are not only extremely necessary to the State of Massachusetts, but are also of national importance. He had always been in favor of extermination rather than of attempting to limit and control, but he pointed out the very great difficulty of exterminating the species if the work is mainly directed toward the destruction of the eggs, referring in this connection to his early statement in this regard, in which the destruction of the eggs had not been deemed of prime importance. He thought, however, that in this particular he had been too extreme. He pointed out the absolute futility of any efforts at extermination which did not promise complete results. All that he had said in criticism of the Commission had been relative to the operations prior to Professor Fernald's controlling connection with the work. He heartily appreciated the value of the present methods as detailed by Professor Fernald. He felt that if at the outset a supreme effort had been made, with the aid of a very large appropriation, complete extermination of the insect could have been accomplished. He gave a summary of some early work and his criticism of it. He was somewhat inclined to question whether we are now justified in working on the basis of extermination through a State commission, or whether it would not be better to encourage the efforts of private individuals wherever the insect occurred, as is the case with other insect pests. He complimented very highly, however, the present work of the Commission. In discussing the subject of parasites, which had been referred to by Mr. Fernald, he was not inclined to agree with the idea that the aim of the commisson at complete extermination detracted at all from the necessity of undertaking the importation of foreign parasites. He said that such introduction could be accomplished at comparatively slight expense and would aid just so much the object of the Commission, pointing out also the greater usefulness of European parasites over native ones if introduced without secondary parasites. This would be particularly evident if his idea of the greater value of the destruction of the larvæ rather than the eggs were conceded.

In illustration of the great weight and value of Professor Riley's ideas on this subject, Mr. Fernald referred in the most complimentary way to the value of his long years of labor in the field of economic entomology, which had resulted in a store of information used and appreciated by all the workers of the world at the present day. He gave some statistics of the injury capable of being done by the gypsy moth in the State of Massachusetts, basing his deductions on the value of farm products and the estimated value of forest and shade trees (Mr. Lintner interjecting in the latter connection that the Saratoga elms were insured by the State at $500 each). Taking the probable injury from

this moth as a basis, he pointed out that a comparatively trifling tax only would be necessary to raise a sum sufficient to control the pest, and was very strongly of the opinion that the work of the Commission should be upheld and continued.

Mr. Howard said he was familiar with the work of the Commission and had gone over the territory and examined the methods of procedure in detail somewhat recently, and was convinced that anyone, seeing the operations and the results already reached, would be impressed with the fact that the work is now being done in the best possible way and according to methods which are most likely to accomplish the ultimate extermination aimed at. He offered a resolution regarding the work of the Commission, which was subseqently acted upon by the Association.

Mr. Lintner said he had been one of the first called to inspect the work and the conditions of the work, and had been deeply impressed with the amount of exertion necessary and the difficulties of successfully prosecuting it. He also had been most favorably impressed with the value of the methods at present employed. Whether ultimate extermination would prevail or not was at present, of course, merely a matter of opinion, but he was convinced of the necessity of continuing the work on the basis of extermination rather than mere control.

The next paper was read by Mr. Lintner on the striped "Cottonwood Beetle" in which he drew attention to the threatened destruction of the basket-willow industry of Onondaga and some other counties of western New York, from the ravages of an insect which has long been known as the striped cottonwood beetle, *Lina scripta* Fabr., but which hitherto has not been regarded as injurious. After describing the insect and its habits, and giving an account of the willow industry and its commercial importance he related the methods which had been made use of to control the insect and especially drew attention to a mechanical contrivance, called a "bug catcher" which had proved very effective for the collection and destruction of the beetles.

Mr. Webster read a somewhat technical paper on the probable origin of the genus Diabrotica This was followed by a paper by Mr. Hopkins of Morgantown, West Va

ON THE STUDY OF FOREST-TREE INSECTS.

The study of the insects affecting forest growth, from an economic standpoint, is in many respects a unique branch of economic entomology, which should in our opinion be designated by the term "forestry entomology."

The importance of advancement of knowledge in this particular branch of science may be inferred from some references to the character of insect injuries to forest growth; to estimates of the amount of damage and the annual pecuniary loss occasioned by such injuries; to the limited knowledge of this class of insects, and to the possibilities of preventing a large per cent. of the loss by the adoption of simple, practical methods of combating the pests.

Character of Injuries.

The injuries to forest growth may be separated into two classes, those affecting the living plants and those affecting the dead or dying plants. Of the former we have injuries to the foliage by leaf-eating, leaf-mining, sap-sucking, and gall-making insects; to the twigs and branches by sap-sucking, twig-mining, bark and wood boring insects; to the trunk by bark and wood-boring, and to the roots by wood-boring, bark-boring and sap-sucking species; the effect of the injuries thus caused upon the living plant being either destructive or detrimental to its growth or usefulness.

The injuries of a destructive character are those caused by insects which occur in sufficient numbers and make their attack in such a manner as to destroy or weaken the vitality of the tree sufficient to be the prmiary cause of its death.

The injuries of a detrimental character are those which are detrimental to the health, perfect growth, or future usefulness of the tree or its product, but do not cause its death.

Of the injuries affecting the dying and dead trees we find, as among those affecting the living, some which are of a destructive character, while others are simply detrimental. The destructive injuries are those caused by wood-boring insects, which render the wood worthless for any practical use to man. The detrimental injuries are those which produce defects in the wood and hasten the decay of the affected parts.

Character and Extent of Damage to Forests by Insects.

Few persons who have not given considerable thought to the subject realize the serious character of insect depradations upon our forests and forest products. This is evident from the fact that the subject is seldom discussed at the meetings of forestry associations and is rarely referred to by writers upon forestry economy in this country.

If we were to assert as our belief that the annual damage and loss occasioned by insects to owners of forest and forest products in the United States was greater than that caused to the same by fire, few persons, if any, would believe that it could be possible. Yet when we come to consider the varied losses resulting from insect depredation, both in a destructive and detrimental manner and in the general influence of their work upon the forest economy of the country, we believe that such an assertion would not be far from correct.

The pine and spruce killed by bark beetles over vast areas in New England and in the Southern States within the last few years has caused an enormous loss of valuable timber ; yet this is only a small portion of the damage to timber by insects. That caused in oak by the oak timber worms (*Lymexylon sericeum* and *Eupsalis minuta*), the Columbian timber beetle (*Corthylus columbianus*) and the carpenter moths of the family Cossidæ, to the chestnut by the chestnut timber worm (*Lymexylon sericeum*), and to the tulip and other kinds of timber by the Columbian timber beetle, all of which attack living trees, will equal that caused by many forest conflagrations. Then when we come to consider the damage to the wood of dying, dead and felled timber, and the work of destruction only begun by fire and completed by wood-boring species, it appears to us that the damage caused by insects is at least equal to that caused by fire.

There is also another feature of the question, and that is in reference to the effect of the detrimental and destructive ravages of forest insects upon the forestry economy of the country. Owing to the large amount of timber destroyed and rendered defective by insects, it is necessary for the manufacturers to cut over a larger area than would otherwise be necessary in order to supply the demand for the best grades of lumber and other timber products. According to a statement by Hon. J. Sterling Morton at the last meeting of the American Association of Agricultural Colleges and Experiment Stations, the area cut over every day in this country to supply the demand for forest products is 30,000 acres. From our observation in the lumber regions of West Virginia it would indicate that at least ten per cent. less timber might be cut each year for this purpose were it not for the detrimental ravages of insects upon the standing and felled timber. Therefore, in this item alone the annual loss to the country and to the manufacturer is enormous, for it must be remembered that a large per cent. of the defective lumber is manufactured and disposed of at a loss to the manufacturer, and is often the cause of serious loss to the consumer.

No accurate estimates of the pecuniary losses caused by forest insects can be made. Yet with the knowledge gained on the subject from recent investigations of the ravages of forest tree insects, from correspondence with lumber manufacturers upon the subject, and reference to the statistics of forest products, we feel justified in presenting some figures which will at least indicate the extent of the loss.

We would estimate the loss caused by bark beetles of the family Scolytidæ, which have caused the death of pine and spruce trees over vast areas within the last ten years,

at an average of $5,000,000 per year ; by bark and timber beetles of the Scolytidæ family causing defective wood in felled timber, $1,000,000, and by the same in timber injured by fires and other causes, $1,000,000 ; by the Columbian timber beetle to standing and living timbers, an average of $1,000,000 per year ; by the oak timber worms and the carpenter worms to the different species of oak, an average of $2,000,000 per year ; to chestnut timber by the chestnut timber worm, which is rendering one of the most valuable woods almost worthless, an average of $1,000,000 ; by wood borers of the family Cerambycidæ to standing timber injured by fire, $2,000,000 ; to felled timber and saw logs by the same kind of insect, $2,000,000 ; by other wood-infesting insects to standing and felled timber, $2,000,000 ; by foilage-infesting insects to living forest and shade trees, $3,000,000 ; by the white pine weevil, plant lice, scale insects, etc., to young forest growth, $1,000,000 ; by the powder-post beetles (Ptinidæ) to forest products, such as seasoned handles, spokes, hoop-poles, building material, etc., $100,000, and by miscellaneous insects not included in the above estimates, $3,000,000—a total of $25,000,000 direct annual loss from insect ravages, which is without doubt a low estimate.

To the above could be added the loss to manufacturers in manufacturing and disposing of defective material, to consumers from the use of the same, and to the indirect loss to the country in the diminished forest area due to insect ravages ; all of which, could it be estimated in dollars and cents, would doubtless equal at least ten per cent. of the total value of the annual forest products of wood material in this country, or about $100,000,000 annually.

With Further Knowledge on the Subject Much of the Loss can be Prevented.

Probably one of the principal reasons why the economic study of forest insects has been neglected in this country is the prevalent belief that few, if any, practical methods can be found to prevent loss from their injuries. It is true the methods used to prevent loss from the attack of farm, garden, and fruit insects can not, as a rule, be successfully used against those affecting forest growth ; neither can many of the successful European methods of combating forest insects be adopted in this country. But there are simple, practical methods known which, if better understood by forest owners and manufacturers of forest products and properly applied by them, would prevent the annual loss of many millions of dollars' worth of timber.

Some of the results recently obtained and facts determined in the investigations now in progress in West Virginia in reference to the proper time to fell timber to prevent detrimental injury by insects, the utilization of defective material to the best advantage, and the introduction of predaceous and parasitic insects to prevent the undue increase of destructive species lead us to believe that many of the more serious troubles can be easily controlled when we learn more of the habits of the insects and the various conditions, favorable and unfavorable, for their development.

Additional Knowledge and More Special, Original Work Necessary.

Further original research and additional published knowledge are sadly needed in this branch of economic entomology. As compared with the knowledge of insects affecting other economic plants, scarcely anything is known of the life history and habits of even our commonest forest-tree insects. Consequently, the field for original work in forestry entomology is a broad one, rich in interesting material as well as in possibilities of important discoveries.

One of the most important aids toward advancement would be, in our opinion, carefully prepared monographs of the insects known to infest the different economic forest trees, on a similar plan to that adopted by Professor Forbes in his recently issued part of "A Monograph of insects injurious to Indian Corn."

Previous to the undertaking of work of this kind, however, further knowledge is necessary in reference to the food habits of the insects found upon or within the different host plants, and whether they are destructive, detrimental, beneficial, or neutral in their

economic relation to the host. This important information can be best and most reliably supplied by specialists who are studying the different families of insects, and by those who will make a study of the food habits and life history of certain classes of insects which infest forest growth, such as foliage-infesting, bark-infesting, and wood-infesting insects, etc., as special lines of research.

If specialists in these various lines will keep in mind the importance of noting the host relations of the species they collect or observe on forest growth, and will publish the knowledge thus obtained, together with lists of species taken on the various economic forest trees, they will contribute valuable service to the country in the rapid advancement of forestry entomology.

Mr. Webster read the following paper:

THE IMPORTATION AND REPRESSION OF DESTRUCTIVE INSECTS.

By F. M. Webster, Wooster, Ohio.

In the year 1795 my topic would have sounded remarkably visionary and illogical; not that it was not known that destructive insects were being brought into this country from England and Europe, but that there should be any united action to prevent such importations, or to suppress them after being introduced, would heve sounded unreasonable and unpractical. But, come to think of it, can we name a single imported insect that has been repressed, or, in fact, has been seriously impeded in its diffusion over the country, by any systematic obstacles placed in its way by the action of man? Is it not nearer the truth to say that we have, as a people, assisted this sort of immigrants, both in reaching this country and in getting inland as fast as possible after they had landed? Our entomologists have increased in numbers and efficiency to deal with these pests, but I do not know of a single one that we have prevented from coming to this country or stamped out after it had reached here.* That we have and are saving the country millions of dollars annually by our advice and experiments I freely admit, but that is only a temporary relief, and by no means a protection against future depredations and losses. Now, there must be something the matter somewhere, and if not with the entomologists, as I feel that it certainly is not, then wherein lies the obstacle? Entomologists do not make the laws, nor are we always able to get those properly enforced that we do have; but that does not settle the problem. For my own part, I have very little faith in State laws, even if they could be enacted, and have often asked myself the question whether or not it was possible for a republican government, composed of minor governments, possibly, as in our case, numbering nearly half a hundred to protect its people from the immense losses occasioned yearly by destructive insects whose place of nativity is known to be thousands of miles away and across wide stretches of ocean which they could never have crossed unaided.

At present we seem unable to deal with the problem intelligently and practically, even within our own borders. We can not, as a people, protect ourselves from each other, much less from countries who very naturally have less regard for us than we have for ourselves. It was with such feelings that I watched the diffusion of the San Jose scale, even after it had been located. Here was a simple problem in national economic entomology, and the question appeared to me to be composed of two propositions, viz: Could we do anything with it? and if so, what would be the importance of the entomologist in this transaction? We have been steadily gaining strength during the last quarter of a century, and I was a little desirous of seeing how powerful we were getting to be, how much we could do to stop the spread of this pest, as well as to effect its extermination where it had already gained a foot-hold. True, we had no laws to sustain us; but if we could but show the necessity for them we would have accomplished much, for, while

*See appended note at the end of this paper.

the San Jose scale is the latest importation, it by no means follows that it will be the last. It is all right to study the biology of the insect, and this is really the first step to be taken, but the duty of the economic entomologist does not stop there by any means. The man who has been unfortunate enough to get the thing in his orchard wants to know all he can learn about it, but the one who is free of it would vastly more like to know how to keep free of it. Some of you are aware that I am not in the least in sympathy with the manner in which we have been dealing with this pest, or rather with those who have knowingly carelessly harbored it. I do not say this with a spirit of fault finding or criticism, but rather with the idea of improving upon the policy. I fully submit that it is not right to knowingly wreck the business of any nurseryman who is willing to do everything in his power to prevent distributing such a pest with his stock ; but it seems to me that we commit even a greater mistake and do a more unjust act when we say that such a pest is in a certain locality, thereby throwing the onus on both the innocent and the guilty. This appears to me to be the very worst sort of an injustice, and places a premium on dishonesty. We should either give the name of the proprietor or else make no public statement whatever, giving him notice that any attempt to send out infested trees or plants will result in a prompt exposure and public condemnation.

If I were to say that a member of this association was a murderer, it would reflect on the honour of all of us, and would serve to protect the guilty one from justice, provided there was such a one among us. Hereafter when we have to quarantine, let it be against individuals or firms and not against States or portions of States in which the innocent outnumber the guilty. We must use harsh and severe measures where such are necessary in order to be just to the deserving, but we have no right to make these deserving ones a partner in dishonesty with the unworthy and disreputable. To do this is but to place ourselves in a position where we are sure to be imposed upon by the latter and secure the merited distrust of the former. The people are coming to place some of their interests in our keeping, and if we would hold on to that confidence we must deal justly but firmly with those who threaten such interests, with the sole aim of profiting thereby. Even if entomologists were clothed with the right to enter into an agreement with nurserymen to keep the presence of a dangerous pest a secret from the public, which I strongly question, it is poor policy to do so. For a public servant to make private arrangements with those harboring public enemies is, generally speaking, a risky business and not usually conductive in elevation to the estimation of those whose esteem we can not well afford to ignore. There should be a discrimination between the deserving and the undeserving, but it should be extended and not promised, and even then with the understanding that it was entirely in the way of official assistance. If we follow the proper course, so as to merit the confidence of the people, the latter will be perfectly satisfied with the information that infected nurseries are under strict surveillance, and nothing infected will be allowed to go out ; but let there be a few more revelations of the actions of some of these, such as we have seen within the last year, and people will naturally begin to speculate as to whom we are assisting and whose interests we are protecting.

I mention these things because I believe we can improve upon the policy that some of us have been following, largely by force of circumstances. What I would urge is this: First, a uniform policy to be followed as closely as our surroundings render possible by all of us ; second, on the information of an infested nursery coming to us the proprietors are to be informed that no infested stock is to be sent out, and that they are to promptly go to work to stamp out the pest, and that any attempt to evade these rules will result in a prompt exposure. If it is known that their trade will not suffer if they choose to purchase their stock from uninfested localities until they have destroyed the pest on their own, most men will see at once that it is the least expensive way out of the trouble. I am satisfied that there is a method of procedure that will work the least hardship to the deserving, yet will compel the stubborn to keep infection confined to their own premises and stamp it out there as soon as possible. I believe that we hold the balance of power, so to speak, and need not barter our influence, but hold it to be sought for by those who wish to escape with the least trouble and loss If we are but just in our actions there will no trouble about the better class of nurseymen siding with us, and we

shall have no difficulty in indicating the dividing line that separates the honorable from the dishonorable, and it will avail nothing for a belligerent firm to close their grounds and books against inspection and then demand our proof of infection. The very lack of proof of non-infection will be sufficient to fasten suspicion upon them.

I have noticed that the services of entomologists have been quite in demand during the last year by nurseymen who were free of the San Jose scale, and the statements of such entomologists were used in the advertisements of these firms; and I think the influence of Dr. Lintner and myself has been felt by at least two nursery firms when it came to the question as to whether they could continue to impose on the public or not. Now, while, as I stated, we have no laws to sustain us, we have a strong public sentiment in our favour, quite sufficient to influence the honorable to favour our plans, and the others we can whip into line, so to speak, by working on their interests. While we have not come out of this contest just in the shape that I wish we had, we have certainly placed our profession on a better footing and shown that we have a power to do for right and justice; that we can help the deserving and at the same time deal firmly and judiciously with the undeserving and disreputable; and so long as we are faithful to our trust we shall be able not only to hold our influence but greatly increase the same.

I confidently look for considerable aid from nurseymen themselves in the matter of preventing the distributing of orchard pests. The most pushing and energetic are beginning to see that it will pay to spray their trees year after year in the nursery row with both insecticides and fungicides; that by so doing they will get a better growth and consequently a larger number of first-class trees that will bring a better return for use of their land and labour. Now, these are not likely to be so blind as not to see that to be able to warrant their stock free from insect and fungus enemies will give them a prestige, and they will thus guarantee every bundle of stock that is shipped from their grounds. When we reach this stage of advancement it will be a small matter to get a United States law that will make this a condition of acceptance for transportation by the railway and express companies.

In the past our advice and cautions have been more or less ignored, but I think if a nurseryman were about to import trees or bring them from California he would think of consulting the United States entomologist in regard to the risk he would run with respect to injurious insects. And there is little doubt that there will be much more caution exercised in future than there has been in the past, and the next new thing we get we shall be better prepared to exert our power and influence than we were in this case. I am satisfied that the San Jose scale can be stamped out where it has been introduced, at least between the Rocky and Alleghany mountains. East of this area it will have to be exterminated or else many nurseries will be compelled to suspend business for lack of customers, and they are not going to do this in the near future. We have done well this time, but we will do better in the future.

NOTE.—The fluted scale of the orange (*Icerya purchasi*), though it has been subjugated in California, at a saving of thousands, if not, indeed, millions, of dollars (and the importation of the natural enemies whereby this was accomplished was the greatest achievement ever attained in practical entomology), still it has yet to be exterminated. So of the gypsy moth (*Ocneria dispar*), introduced into Massachusetts by a lamentable piece of carelessness on the part of an entomologist many years ago, while it has been overcome in some localities, it has not been exterminated. I am free to confess that up to the time of presenting this paper I had very serious doubts as to the possibility of this ever being done; not because of any fault or neglect among those intrusted with the work, but because it appeared to me that they had attempted an impossibility. I have since spent a day in examining the work in all of its details, and believe that I saw not only what had been done, but also what yet remained to be accomplished; and that, too, with unprejudiced eyes and mind, and in company with one who clearly had no other motive than to show me every feature precisely as it existed, without magnifying, minifying or concealing anything. I now feel confident that the question of the extermination of this

pest in Massachusetts is simply one dependent upon the support in future given those in charge of the work; that with proper support financially this pest will be absolutely wiped out of existence in America, and that the achievement will be the greatest yet attained, and one of which we shall all feel proud, while it will redound to the credit of economic entomology all over the civilized world.

F. M. W.

Mr. Fernald asked if anyone was aware of wilful and malicious importations of injurious insects from Europe, referring in this connection to the report of the possible transportation of certain American insect pests in the opposite direction. He was himself aware of no such cases.

Mr Smith said the only case known to him was the importation of the Ailanthus silkworm.

Mr. Sirrine, referring to Mr. Webster's communication, said that he had found about the 1st of July instances of the purchase of apple trees badly infested with living San Jose scale, which had supposedly been effectually treated before being sold and sent out.

Mr. Smith said that he was aware that these trees had been treated with gas during the winter, and described the methods which had been followed. In the examination made by himself he had found no living scales, but undoubtedly some living specimens had been left, and probably from these the trees had become re-stocked. He pointed out the necessity of examining every scale before it was possible safely to pronounce stock immune, and therefore the impracticability of giving any such indorsement to nurseries.

Mr. Riley emphasized the extreme difficulty and great liability to error on the part of entomologists should they follow the plan of pronouncing any particular nursery free from scale. In some cases circumstances may warrant such an indorsement, especially if there is reason to believe that the insect in question is recently introduced and therefore confined to a restricted area or single point of infestation, as seemed, indeed, to be the case in the first discovery of the San Jose scale in the east. In such cases it may not be necessary to give publicity to the point of infestation if proper measures are being taken to suppress the insect. It was on this basis that he acted in the case of the San Jose scale; but when an insect is known to be widely disseminated a full public statement of the extent of the infested locality is desirable.

Mr. Smith agreed with Mr. Riley as to the difficulty of pronouncing any nursery untainted, and had decided for himself not to give clean bills of health to any nurseries in future.

Mr. Southwick read a paper entitled "Economic Entonomological Work in the Parks of New York City."

Mr. Webster read a paper on the "Insects of the year in Ohio." The time available for the reading of papers having expired, the three following, whose authors were absent, were read by title only, viz.:—"On the Natural Conditions which Affect the Distribution and Abundance of Coccidæ," by T. D. A. Cockerell, Las Cruces, N. Mex.; "How shall we Improve our Collections?" by C. P. Gillette, Fort Collins, Colorado; and "Carbon Bisulphide for Crayfish," by H. E. Weed, Agricultural College, Miss.

The following resolution relative to the Gypsy Moth Commission, introduced by Mr. Howard, was now brought up and received the unanimous indorsement of the Association:

Resolved, That it is the sense of this Association that the present Gypsy Moth Commission is prosecuting its work in the most intelligent and praiseworthy manner, and that its hands should be upheld by the State authorities.

Mr. Lintner presented the following resolution, which was also unanimously adopted:

Resolved, That this Association has learned with deep regret of the intended discontinuance of *Insect Life* with the present number. In consideration of the unusual value of this publication, the eminent ability with which it has been conducted, the high appreciation in which it has been held by all of our entomologists and those in other countries, and the importance of the published investigations into the life history of insects, largely on their economic aspect, this Association earnestly requests of the Department of Agriculture that the resumption of the publication of this invaluable publication may be directed at no distant day.

The Committee on Nominations, consisting of Messrs. Lintner, Davis and Rolfs, proposed :

For *President*, C. H. FERNALD, of Amherst, Mass.
For *First Vice-President*, F. M. WEBSTER, of Wooster, Ohio.
For *Second Vice-President*, HERBERT OSBORN, of Ames, Iowa.
For *Secretary*, C. L. MARLATT, of Washington, D. C.

On motion, the chair was instructed to cast the ballot of the Association for the gentlemen named, and they were declared duly elected.

On motion of Mr. Southwick, the reading of the minutes of the entire meeting was dispensed with, and on motion of the same gentleman a vote of thanks was tendered the President and Secretary of the Association in recognition of their services.

On motion of Mr. Howard, the local committee in charge of the meeting at Springfield was given a vote of thanks.

President-elect Fernald took the chair and briefly expressed his thanks for the honour conferred upon him.

The Association then adjourned.

WILLIAM H. EDWARDS.

Our readers will all, we are sure, be glad to receive the excellent portrait prefixed to this volume of the well-known and now venerable entomologist, Mr. W. H. EDWARDS, of Coalburgh, West Virginia. His life-long work has been the study of diurnal lepidoptera, and the results of that work are splendidly set forth in the beautifully illustrated volumes of his "Butterflies of North America." In April, 1868, the first part was issued, and at once commended itself to entomologists everywhere by the exquisite beauty and finish of the plates and their faithfulness to nature. In July, 1872, the first series, forming a large quarto volume with fifty plates, was completed. The second series, containing fifty-one plates, was begun in May, 1874, but not finished until November, 1884; the less frequent issue of the parts being more than compensated for by the increased value of both plates and letter press. When the work was begun, as Mr. Edwards stated in his preface, little or nothing was known of the eggs, larvæ, or chrysalids of any except the commonest butterflies, and accordingly his first volume illustrated only the perfect state. In 1870 he made the notable discovery that eggs could be satisfactorily obtained by confining the female butterfly of any species with the growing food-plant of its larva, and at once began the study of the life-histories of a number of species previously known only in the imago state. The results of these studies are admirably set forth in the letter press as well as in the plates of the second and third series; on these are accurately depicted eggs and larvæ in their different stages, as well as chrysalids and imagoes. Many wonderful discoveries have been made during these investigations, among the first being that of the seasonal trimorphism of *Papilio Ajax* and the dimorphism of *Grapta interrogationis* and of *G. comma.* The process of breeding was soon taken up by Mr. Edwards's friends and correspondents all over North America, and, aided by the general extension of railways over the continent, he was able to get eggs of butterflies from widely distant localities, and to follow them successfully through all their stages. Thanks to his efforts the reproach of ignorance of the preparatory states of our butterflies has been removed, and though much remains to be learnt, vast progress has already been made. The first part of the third series was issued in December, 1886, and in October last we had the pleasure of welcoming the sixteenth. Far from showing any decline from the author's high standard of excellence, this last issue may justly be regarded as the climax of good work, both on the part of the writer and the artist. All through Mr. Edwards has been fortunate in having his wishes so ably carried out by his artist-assistants—Mrs. Mary Peart, of Philadelphia, who has drawn most accurately nearly all the plates, and in order to do so satisfactorily has reared most of the caterpillars; and Mrs. Lydia Bowen who has so exquisitely performed the work of colouring. Many of the plates of the third series have been drawn by Mr. Edward A. Kellner, of Philadelphia.

In addition to the great work that we have just referred to, Mr. Edwards has contributed largely to the periodical literature of the science, especially to the proceedings and transactions of the American Entomological Society and to the *Canadian Entomologist*. His first contribution to its pages was published in the third number of the first volume, in 1868, and he has continued to favour it with articles of great value ever since, his last paper, in the September number of volume xxvii., being the one hundred and sixty-eighth which he has written for our journal.

Mr. Edwards was born on the 15th of March, 1822, and will soon complete his seventy-fourth year. That he may long be spared in health and prosperity to carry on his excellent work is the cordial wish of the writer and all his friends.—C. J. S. B.

BOOK NOTICES.

The Butterflies of North America, with coloured drawings and descriptions, by W. H. Edwards. Third series, part xvi. Houghton, Mifflin & Co., The Riverside Press, Cambridge, Mass.

Though nearly a twelvemonth has gone by since the preceding part was issued, we could well afford to wait with patience for another number, when our author rewards us with so much that is remarkably interesting as well as valuable regarding the life-histories of some hitherto little known butterflies.

The first plate, which as usual is exquisitely drawn and coloured, depicts the female of *Parnassius smintheus*, Doubl.Hew., and both sexes of the variety *Hermodur*, H. F. Edw., together with the egg, larva in all its stages, chrysalis, last segments of the male butterfly, and many highly magnified details. After giving a description of the various stages of the insect, the author relates many most interesting facts regarding the life and habits of the butterfly, which have taken expert observers in the States of Colorado, Montana and Washington no less than twenty years to accumulate! The account is concluded with a description of the formation of the extraordinary pouch or keel which is to be seen beneath the abdomen of the females of various species of Parnassius. That this should be formed by the male is one of those strange marvels that render the careful study of the lives of our butterflies so interesting and attractive.

The second plate depicts both sexes of *Satyrus Charon* and the male of its variety *Silvestris;* also the egg, the various stages of the larva, the chrysalis, and many details. The imago and the several preparatory stages are described, and a short but interesting account is given of the habits of the butterfly and the rearing of the larvæ.

On the remaining plate are figured the egg, three stages of the larva with details, and both sexes of the imago of the British Columbian species (*Chionobas gigas*), Butler. After describing the preparatory stages so far as known, the author relates the differences in appearance and habitat between this species and *Californica* and *Iduna*, which are frequently confused in collections. *Gigas* is shown to be confined, so far as is yet known, to Vancouver Island, where the male frequents the tops of the highest mountains, the female being usually found much lower down ; *Iduna* inhabits the slopes of the evergreen red-wood forest in north-eastern California on the Pacific coast ; and *Californica*, the hot arid regions of east Oregon, Washington and the semi-desert portion of north-east California. "*Gigas* is semi-Arctic, living amid the cold, dark fir forest ; *Iduna* is temperate, living in the mild, dark red-wood forest ; *Californica* is semi-tropical, living in open, dry, warm glades in the "bushland" on the border between the forest and the open plains. *Gigas* alights on bare rocks ; *Iduna* on green twigs ; *Californica* on dead or dry grass." But we must refer the reader to the book itself for all the interesting particulars regarding these strange butterflies.

The wonder to us is that so few entomologists subscribe to this magnificent work. The parts are issued at such long intervals that the cost is very light ; those who have secured them know what a treasure they possess and how highly they prize it.—C. J. S B.

THE NATURAL HISTORY OF AQUATIC INSECTS, by Prof. L. C. Miall, F. R. S. London and New York, MacMillan & Co. (66 Fifth avenue, N. Y.; price, $1.75), pp. 395.

This interesting work is intended, as the author states, "to help those naturalists who take delight in observing the structure and habits of living animals," and also to revive an interest in the writings of some of the old zoologists who did notable work in their day, but who are now almost forgotten, namely, Lyonnet, Réaumur, Swammerdam and De Geer, of whose lives and work he gives a short account.

To any lover of nature who wishes to look into the lives and doings of living creatures, and to investigate their structure and appliances for carrying on the business of their lives, this book will prove a very great help as well as an unfailing pleasure, and it ought to lead many a reader to explore for himself the ponds and pools in his own neighborhood which teem with insect life. The different groups of insects that live in the water in their larval or perfect states, are treated of in turn—water beetles and the larvæ of many flies, the caterpillars of some moths, caddis worms, May flies, alder flies (Sialidæ), stone flies (Perlidæ), dragon flies, pond skaters, water boatmen, etc. The very names of these insects bring to mind what one cannot fail to have seen and watched and wondered over. To have many of these wonders explained and described, and to have the insects themselves depicted and the peculiarities of their structure made clear by excellent woodcuts, is what we owe to the author of this book, and we hope that many will turn to its pages with profit and delight. It is a handsome volume, with clear, large type and a number of very good illustrations.—C. J. S. B.

The Cambridge Natural History, Vol. V. Peripatus, by Adam Sedgwick, M.A., F. R.S.C.; Myriapods, by F. G. Sinclair, M.A.; Insects, (Part 1) by David Sharp, M.A., F.R.S. London and New York, MacMillan & Co.

The possession of some such work as this is of primary importance to the student in any department of zoology, to enable him to obtain, and have at hand for reference, a general knowledge of the varied groups into which, for convenience of study and classification, the animal kingdom is divided. In every home that can afford the luxury of books it will also be found most valuable, affording a continual fund of instruction, and implanting in the children a spirit of inquiry, and of interest in the many wonders of nature. It is only about ten years since the publication, in six sumptuous quarto volumes, of the Standard Natural History, edited by Prof. Kingsley, and having as contributors many of the most eminent scientific men of America. To a certain extent their references and illustrations were more largely drawn from the fauna of our own continent, although a work of this general character must not be expected to be in any way restricted in its choice of examples of any group. Our knowledge of the animal kingdom is, however, so constantly being enlarged by the labours of an ever increasing and better equipped body of investigators, that the present work will be found to be considerably in advance of any previous publication. The editors are S. F. Harmer, M.A., Superintendent of the Cambridge University Museum of Zoology, and A. E. Shipley, M.A., University lecturer on the Morphology of Invertebrates. These names, and those of the authors of the various memoirs, are a guarantee as to the accuracy and completeness of the work, and of its fitness either for the private student or for the teacher of zoology. When finished it will consist of ten handsome large octavo volumes, which will form a desirable addition to any library.

Mr. Sedgwick's memoir on Peripatus indicates at once the marked advance that has been made in some directions of biological research. In the Standard Natural History, where it is placed as a sub-class—Malacopoda—of the insects, this curious genus occupies scarcely more than a page, for the knowledge of it was than very fragmentary. Mr. Sedgwick, whose studies of the genus have been very extended, and who has written previous monographs, gives a very interesting account not only of the outward appearance of this very peculiar creature, but also of its embryology, development and habits. There are numerous illustrations and a map showing the distribution, which extends through portions of South Africa, Australia, New Zealand, South and Central America and the West

Indies. Described by its discoverer, (Rev. L. Guilding), as a mollusc, from its slug-like form, this unique animal is now found to belong to the arthropods, although possessing features not belonging to other members of that division. Indeed it is said to "stand absolutely alone as a kind of half-way animal between the Arthropoda and the Annelida." As a very primitive type, exhibiting affinities to both groups, it possesses a special interest to zoologists. The species are few in number, and are of elongated slug like shape, with from seventeen to thirty four pairs of legs; subsisting upon animal food and shunning the light.

The Myriapoda are stated by Mr. Sinclair in his introduction, "not to have attracted much notice until comparatively recent times. Compared with insects they have been but little known. The reason of this is not hard to find. The Myriapods do not exercise so much direct influence on human affairs as do some other classes of animals; for instance, insects. They include no species which is of direct use to man, like the silk-worm or the cochineal insect, and they are of no use to him as food." To the farmer's crops, however, some species, known as wire-worms, (Iulus) do considerable damage, while many of the carnivorous species must, on the other hand, be of considerable assistance in destroying injurious insects. Myriapods are those elongate, many-footed creatures, lurking under rubbish and in dark places, which are usually called centipedes and millepedes. Regarded with distrust on account of the venomous bite of some of the large tropical species, their appearance and habits of concealment produce in most people a decided aversion to more intimate acquaintance. The author, however, gives a very pleasing summary of their habits, and proves that a study of these creatures, as is true of all forms of life, however repellant to the ordinary observer, is far from being devoid of interest. Our popular names are not sustained on closer examination, for none of the species have nearly a thousand legs, and a large proportion have far less than one hundred. The number varies from nine pairs in the tiny Pauropus, to about one hundred and seventy pairs in some species of Notophilus. The Myriapods have many affinities to the insects, and have been classed with them by many authors. They differ from insects, as well as from the other classes of arthropods, in having true, jointed legs on the posterior segments of the body. Mr. Sinclair recognizes five orders, the species of which vary in length from the one twenty-fifth of an inch (Pauropus) to almost a foot, as in the tropical centipedes. He does not mention, however, perhaps because it is now extinct, the great centipede, described in the Japanese tale of My Lord Bag-of-Rice, which inhabited Mukade-yama (Centipede Mountain) on the shores of Lake Biwa, and which was over a mile long, with exactly one thousand feet on each side of its body. Some of the forms, as Glomeris, are quite short and stout; others, as Iulus, have long cylindrical bodies; while Notophilus and Geophilus have the body very thin and elongated.

Eighty pages are occupied by these interesting memoirs on Peripatus and the Myriapoda, and in the third chapter Dr. Sharp introduces the Insects, and continues their discussion throughout the remaining five hundred pages, in a style that proves him a master of the subject, and also of its presentation to his readers. Naturally, as an Entomological Society, we take a closer interest in this great class, into which are grouped an immense assemblage of small creatures, varying to a wonderful degree in structure and habits, yet having, amidst all this diversity, well-marked relations to one another. To use the author's opening words "Insects form by far the larger part of the land animals of the world; they outnumber in species all the other terrestrial animals together, while compared with the vertebrates, their numbers are simply enormous. * * * * The largest insects scarcely exceed in bulk a mouse or a wren, while the smallest are almost or quite imperceptible to the naked eye, and yet the larger part of the animal matter existing on the lands of the globe is in all probability locked up in the forms of insects. Taken as a whole they are the most successful of all the forms of terrestrial animals. In the waters of the globe the predominance of insect life disappears. In the smaller collections of water many insects find a home during a portion of their lives, and some few contrive to pass their whole existence in such places; but of larger bodies of water they invade merely the fringes, and they make only the feeblest attempt at existence in the ocean."

A not infrequent question is "What is an Insect?" and for the benefit of many who have not opportunity to study entomology, yet to whom some knowledge of the subject is important, it may be answered by the author's brief and clear definition of the class Insecta; or Insecta Hexapoda.

"Insects are small animals, having the body divided into three regions placed in longitudinal succession, head, thorax and abdomen: they take in air by means of tracheæ, a system of tubes distributed throughout the body, and opening externally by means of orifices placed at the sides of the body. They have six legs and a pair of antennæ; these latter are placed on the head, while the legs are attached to the thorax, or second of the three great body divisions; the abdomen has no true legs, but not infrequently has terminal appendages and, on the under surface, protuberances which serve as feet. Very frequently there are two pairs of wings, sometimes only one pair, in other cases none; the wings are always placed on the thorax. Insects are transversely segmented—that is to say, the body has the form of a succession of rings; but this condition is in many cases obscure; the number of these rings rarely, if ever, exceeds thirteen in addition to the head and to a terminal piece that sometimes exists. Insects usually change much in appearance in the course of their growth, the annulose or ringed condition being most evident in the early part of the individual's life. The legs are usually elongate and apparently jointed, but in the immature condition may be altogether absent, or very short; in the latter case the jointing is obscure. The number of jointed legs is always six."

The amplification of this definition and the exposition of the external and internal structure, and of the functions of the various organs, occupy two chapters. Referring to Parthenogenesis, or "the production of young without the concurrence of the male," which sometimes occurs, the remarkable fact is noted that in a few species of saw-flies, gall-flies and scale-insects no male is known, so that they must be considered as perpetually parthenogenetic. The next chapter gives a valuable summary of the embryology and metamorphoses. While the vast majority of insects are oviparous, the eggs deposited varying greatly in number, size and shape, a few species bring forth living young, as in the Aphididæ (green-fly or plant-lice), which thus multiply with extraordinary rapidity. A brief chapter follows on the classification, and it can readily be understood that diversity of opinion has existed, and may long continue, as to the most satisfactory arrangement of the vast hosts of insects. As some 250,000 species have already been described, and several times that number undoubtedly exist, any scheme of classification must, under our present knowledge, fail to adequately provide for the reception of every form. Dr. Sharp points out that owing to the present limited knowledge of the earlier stages of insects, the only complete system of classification yet possible must be based upon the structure of the adult forms. It is noted with pleasure that he does not consider it necessary to make so many orders or primary divisions as has been the tendency of recent authors. Instead of twenty, as recently proposed by Packard, he limits them, much to the advantage of the ordinary student, to nine, viz., Aptera, Orthoptera, Neuroptera, Hymenoptera, Coleoptera, Lepidoptera, Diptera, Thysanoptera, and Hemiptera.

The Aptera are designated as "small insects, with weak outer skin, destitute throughout life of wings or their rudiments, but with three pairs of legs; antennæ large or moderate in size." It is pointed out however that this definition does not clearly differentiate them from many of the young individuals of other orders, and that the order does not, as its name might indicate, include all wingless insects. Two sub-orders are present: Thysanura, with the abdomen composed of ten segments, and Collembola, of not more than six. The study of these insects is attended with more than ordinary difficulty, as their habits and fragile structure make them troublesome to collect and preserve. Campodea, supposed by many authors to represent one of the most primitive types of insect, and therefore of unusual interest, is said to be "so extremely delicate that it is difficult to pick it up, even with a camel's hair brush, without breaking it." The Collembola are the "Spring tails," two of the three families having the abdomen provided with a leaping apparatus which enables them to jump about in a very vigorous

and erratic way. The Aptera are supposed to feed upon vegetable and animal refuse, and can endure both heat and cold, but require moisture, so that they occur most abundantly in cellars, under rubbish, in mosses, and other damp situations.

The Orthoptera form one of the most important orders of insects, both as regards the diversity of structure exhibited, the great size of many species, and the enormous devastation often wrought by their innumerable swarms. Dr. Sharp occupies nearly one hundred and fifty pages with his synopsis of the order, and his admirably written and illustrated account of the various groups should awaken, in all who are fortunate enough to read it, a lively interest in the insect world. He estimates that the order contains, at the lowest figure, 10,000 species, and treats it as composed of eight families. Of these the first is the Forficulidæ, or earwigs; elongate insects, having the abdomen terminated by a pair of clasper-like instruments, often greatly developed. Many of the forms are wingless, and those provided with wings are able to completely fold them up and tuck them under short wing covers, so that they have considerable resemblance to some beetles of the family Staphylinidæ. In Canada earwigs are poorly represented, and the one little species of Labia found in Ontario is but rarely met with. The family Hemimeridæ contains a few small, wingless, blind insects from equatorial Africa, interesting as occurring on small mammals either as parasites or commensals. The Blattidæ, or cockroaches, are both destructive and unpleasant creatures, although some forms are brightly coloured. Canada is not much troubled with these creatures, although a few disagreeable species have been introduced, but in warmer climates they are often veritable plagues. The Mantidæ, or praying insects, are wanting in our fauna, but in tropical and sub-tropical regions the species are numerous and their bodies are often strangely developed; sometimes by leaf-like expansions, serving to make them inconspicuous among the foliage in which they lurk. These developments of structure are even more marked in the Phasmidæ—stick and leaf insects—as shown by the figures of various genera.

The family Acridiidæ contains those very prolific and voracious vegetarians, the locusts and grasshoppers. These breed so rapidly and appear in such enormous swarms as to make less incredible, than it might at first appear, the author's statement, previously quoted, as to the relative bulk of insects and other terrestrial animals. The migratory locusts at times destroy all vegetation over large areas, and may thus produce famine and disease. As Dr. Sharp says, "It is difficult for those who have not witnessed a serious invasion to realize the magnitude of the event. Large swarms consist of an almost incalculable number of individuals. A writer in *Nature* states that a flight of locusts that passed over the Red Sea in November, 1889, was 2,000 square miles in extent, and he estimates its weight at 42,850 millions of tons, each locust weighing one-sixteenth of an ounce. A second similar, perhaps even larger, flight was seen passing in the same direction the next day." The Locustidæ, or green grasshoppers, are more arboreal in their habits, and often have the wings of a very leaf-like appearance. They are also more musical, and capable of strong and sustained performances. The well known American Katydids belong to this family. The last family, Gryllidæ, contains the crickets, whose concerts enliven the summer evenings. The fossorial, or mole crickets, have the front legs most admirably adapted for burrowing.

The treatment of the Neuroptera occupies an equal space and is no less interesting. The first family, Mallophaga, contains the biting or bird lice, so troublesome to birds and mammals. The Termitidæ, or white ants, are one of the most wonderful of all the groups of insects, and the individuals are strangely modified to fit them for their duties in the communities of which they are members. A table is given which shows that as many as fifteen distinct forms may occur (as in *Termes lucifugus*), and many of these may co-exist in the community, while others are only produced as necessity demands. The African species are the most remarkable, *T. bellicosus* forming solid mounds as much as twenty feet high. To sustain the population of these immense colonies, the queen becomes a marvellous egg-producing machine. "Twenty or thirty thousand times the bulk of a labourer," she is unceasingly fed by a band of workers, and as unceasingly gives forth eggs, to the number even of "eighty thousand and upward in one day of twenty-four

hours." To the Neuroptera belong also the ant-lions, dragon-flies and other well known insects. A large proportion are aquatic in their earlier stages, and most interesting in their habits, either as residents of the water or the air.

The last one hundred pages of Dr. Sharp's charming portrayal of the insect world is devoted to a portion of the Hymenoptera, the species of which are estimated at 250,000. This order contains, among its almost inexhaustible forms, those which are of exceptional interest, from the intelligence which governs their actions. Dr. Sharp has called attention to an error which has occurred through hasty writing of the explanation of the anatomy of *Sphex chrysis* (page 490, Fig. 333), where the letter *f* is called a division of the metanotum, whereas it really belongs to the mesonotum. This error will be corrected in the portion dealing with the Aculeata The present volume only treats of the Sessiliventres, those in which the abdomen is broadly and closely joined to the thorax, and the parasitic families of the Petiolata, in which the abdomen is attached by a petiole, or stalk, often remarkably slender and prolonged. The first division includes the sawflies, of which the caterpillar-like larvæ are so injurious to vegetation, and the horntails, whose larvæ bore in the trunks of trees. The parasitic families exhibit much more variety of structure, and the species, even in our northern fauna, are exceedingly numerous. They vary in size; some Pimplids measuring several inches from the head to the tip of the very long ovipositor, while among the Proctotrypids and Chalcids are forms almost invisible to the naked eye. Dr. Sharp clearly tabulates the conditions under which the early life of such parasites is passed.

"1. The egg may be laid outside a larva, and the embryonic and larval developments may both be passed on the exterior.

2. The egg may be laid and the embryonic development passed through, outside the host, but the parasite on hatching may enter the host, so that the post-embryonic development is passed in the lymph of the host.

3. The egg may be laid inside the host, both embryonic and post-embryonic developments being gone through in the fluids of the host.

4. The egg may be laid inside another egg, the embryonic and post-embryonic developments being passed therein."

A large section of the Cynipidæ are not parasitic, but subsist upon plant tissues, producing swellings and distortions, known as galls, in which the larvæ live and develop. Among the illustrations of the hymenoptera are excellent figures of four insects occurring in Ontario and other portions of Canada, viz., *Oryssus Sayi*, *Tremex Columba*, *Thalessa lunator* and *Pelecinus polyturator*, the last three being quite common insects. The illustrations throughout the volume, 371 in all, are both accurate and artistic, and many have been specially drawn for the work. The paper and press work are of the best, and the result is a very handsome volume. The appearance of the next volume, completing this most valuable and enjoyable account of the insects, will be eagerly awaited.

W. Hague Harrington.

Rambles in Alpine Valleys, by J. W. Tutt, F.E.S.; 208 pages, five plates London: Swan, Sonnenschien & Co.

The Editor of *The Entomologists' Record and Journal of Variation* has added another to his popular books on the beauties of nature. This time he takes the reader abroad to the lovely scenery of Switzerland on the Italian slopes of Mont Blanc, where he wanders for the most part out of the beaten track of the ordinary tourist. Much of the volume is filled with charming pen-pictures of the infinite variety of grandeur and beauty to be found among the lofty mountain tops, the towering crags, the densely wooded ravines and the dashing torrents of this secluded Alpine region. The eye of the naturalist does not fail to observe the marvellous variety of animal and vegetable life that is to be found in this limited area; and the author describes many a plant and flower, and especially the gay butterflies and pretty moths with which the region

abounds. Some of the most interesting passages are those that deal with the phenomena of variation caused by environment, the results of the glacial epoch in the distribution of species, the effect of altitude on plants and insects, the evolution of the genus *Colias*, the production of colours, the causes of hybernation, and other topics which arise from time to time as the author rambles through the valleys or climbs the Alpine hills. The perusal of such a book as this must help the reader to see and observe, and lead him on to think out for himself the causes and the objects of the life that everywhere surrounds him.—C. J. S. B.

A Manual for the Study of Insects, by John Henry Comstock and Anna Botsford Comstock; Ithaca, N.Y. Comstock Publishing Co., 1895.

This is a work of 700 pages, profusely illustrated. A table of the classes of the Arthropoda is given, followed by a short characterization of the Crustacea. Thirty-three pages are devoted to the Arachnida, and a table is given for separating the principal families of the Araneida. The Myriapoda are briefly referred to, and chapter iii. begins the discussion of the true insects (Hexapoda). Nineteen orders are recognized, and a careful table is given for their practical determination.

In the remainder of the work, 618 pp., the several orders are treated with tables carrying the student to the families, each illustrated by typical common species, of which brief accounts are given.

In the lepidoptera, diptera and hymenoptera, the uniform system of nomenclature of the wing veins discussed by Prof. Comstock in "Evolution and Taxonomy" is applied throughout the orders. As stated in the preface but slight changes are made from the usual classification of the families, except in the lepidoptera where the system proposed in "Evolution and Taxonomy" is adopted with slight changes. This is remarkably like Dr. T. A. Chapman's classification from pupal characters and the present writer's one on larval characters. All three agree in breaking up the old groups Zygaenidae and Bombyces, and the several members are referred to essentially the same places. The work affords for the first time a means for teacher as well as student to determine the family of any North American insect, for here synoptic tables replace the vague characterization so generally in vogue in zoology. To bring the tables down to species, as is done so satisfactorily in botany, as the author remarks, would make the work of enormous length, not to mention the fact that the present state of our knowledge of insects does not warrant such an undertaking. The work seems a very valuable and timely one.—Harrison G. Dyar.

We wish to add to the foregoing notice our hearty congratulations to Prof. Comstock and his talented wife upon the completion of their excellent work, and our tribute of praise for the thoroughly admirable manner in which they have performed it. It is now a little more than six years since we noticed in these pages the first part of this work, which consisted of 234 pages and 200 wood cuts; we then stated that "judging from the portion before us we have no hesitation in saying that the complete work will be a most valuable and admirable manual of entomology; in clearness and simplicity of style, in excellence of illustration and in arrangement of matter it leaves nothing to be desired." This prediction has been most completely fulfilled, the volume before us being, in several respects, even an improvement upon the original publication. The new illustrations are more artistic, and the diagrams of wing-venation and details are clear and accurate; the synoptic tables will afford any painstaking student satisfactory means of classifying into families any specimens that he collects, while the letter-press and figures will enable him to determine a large number of species. We heartily commend the work to all who are beginning to study entomology, and we can assure others, who have made some progress in the science, that they will find in it a vast deal of help and information that will prove of the utmost value. We may add that the illustrations consist of 800 wood cuts and six beautiful full-page plates, the one forming the frontispiece being coloured. The price of the work is so reasonable that it is within the reach of all.—C. J. S. B.

CANADIAN SPIDERS, by J. H. Emerton. Transactions of the Connecticut Academy, Vol. IX., July, 1894. Thirty pp., four plates.

This interesting and valuable paper treats of spiders collected in various parts of Canada from the Rocky Mountains to the Gulf of St. Lawrence. The author states at the outset that the species differ little from those of the New England States. "Out of sixty-one species, from Labrador to Manitoba, fifty six species live in New England; and twenty-seven out of forty-eight species from the Rocky Mountains. Of the latter no less than forty of the species mentioned were collected by Mr. Bean at Laggan, and of these sixteen are described as new to science. Mr. Tyrrell, of the Geological Survey of Canada, supplied other species from the Rocky Mountain Region, Alberta Territory and Ottawa, and other collectors from the various localities mentioned in the paper. The plates illustrating the new species are admirably drawn by the author, the excellence of whose work in scientific illustration has long been well known and highly appreciated.—C. J. S. B.

REPORT OF OBSERVATIONS OF INJURIOUS INSECTS AND COMMON FARM PESTS, DURING THE YEAR 1894, with Methods of Prevention and Remedy. Eighteenth Report. BY ELEANOR A. ORMEROD, F. R. Met. Soc etc., etc., London; Simpkin, Marshall, Hamilton, Kent & Co, Limited, 1895, pp. 122, lxii, plate.

In this the author has given us another of her most excellent annual reports, if anything, better than those that have preceded it. There are twenty-nine species, besides the two groups, Iulidæ and Vespidæ, fully treated in the report which is illustrated by forty five figures and one excellent plate, the latter devoted to the Stem Eelworm, *Tylenchus devastatrix*, in connection with its recent discovery as injurious to hops. We congratulate the author on being able to give us so much information on Eelworms, Warble Fly and carabid enemies of the strawberry. In fact she has, throughout her report strictly adhered to the plan expressed in the preface, viz., "not to enter again on such of our common infestations as have been repeatedly noticed in my preceding reports, excepting where there was some new information to be given, or (sometimes) needed." This renders the report of unusual value. To do the publication justice is simply out of the question in an ordinary book notice, but suffice it to say that it is in every way a credit to its author.

The writer well remembers an evening spent with the late Frazer S. Crawford, at his suburban home near Adelaide, South Australia. We had been discussing entomology and entomologists, when he made a remark something like this. "Miss Ormerod is a noble woman and is giving both her life and her wealth to the agricultural interests of England, and I cannot understand why she should not be better appreciated by Englishmen." The sentiment will be echoed by American entomologists, but I fear in our hurry and bustle, we forget to drop an occasional word of encouragement and appreciation, such as we ourselves would gladly receive. Working almost alone, and comparatively unaided, in a labour of love not always appreciated, it seems to me that words of encouragement from her colleagues, both in America and out of it, are but matters of justice. Other reports on economic entomology there are, and they come officially from the Board of Agriculture of England, but the writer has searched through them in vain for tokens of originality or just credit for the information contained in them.—F. M. W.

OBITUARY.

CHARLES VALENTINE RILEY.*

The career of this distinguished naturalist, so suddenly closed while in good health, and with apparently many years of usefulness before him, was a remarkable one. Biologist, artist, editor and public official, the story of his struggles and successes, tinged as it is with romance, is one full of interest. Beginning life in America as a poor lad on an

*The following memoir of our lamented friend, Professor Riley, contributed to a recent number of "Science," by Professor A. S. Packard, is so excellent and complete that we prefer to give it in full rather than attempt to prepare another which would not be so satisfactory.—ED.

Illinois farm, he rose by his own exertions to distinction, and to become one of our most useful citizens in science, both pure and applied. His nature was a many-sided one, and his success in life was due to sheer will-power, unusual executive force, critical judgment, untiring industry, skill with pencil and pen, and a laudable ambition, united with an intense love of nature and of science for its own sake. This rare combination of varied qualities, of which he made the most, rendered him during the thirty years of his active life widely known as a public official, as a scientific investigator, while of economic entomologists he was *facile princeps.*

Charles Valentine Riley was born at Chelsea, London, September 18, 1843. His boyhood was spent at Walton-on-Thames, where he made the acquaintance of the late W. C. Hewitson, author of a work on butterflies, which undoubtedly developed his love for insects. At the age of eleven he went to school for three years at Dieppe, afterwards studying at Bonn-on-the Rhine. At both schools he carried off the first prizes for drawing, making finished sketches of butterflies, thus showing his early bent for natural history, and his teacher at Bonn urged him to study art at Paris. But it is said that family circumstances, though rather, perhaps, a restless disposition, led him to abandon the old country, and at the age of seventeen he had immigrated to Illinois, and settled on a farm about fifty miles from Chicago. When about twenty-one he removed to Chicago, where he became a reporter and editor of the entomological department of the *Prairie Farmer.*

Near the close of the war, in 1864, he enlisted as a private in the 134th Illinois regiment, serving for six months, when he returned to his editorial office.

He also enjoyed for several years the close friendship of B. D. Walsh, one of our most thorough and philosophic entomologists, with whom he edited the *American Entomologist.* His industry and versatility as well as his zeal as an entomologist, made him widely known and popular, and gave him such prestige that it resulted in his appointment in 1868 as State Entomologist of Missouri. From that time until 1877, when he left St. Louis to live in Washington, he issued a series of nine annual reports on injurious insects, which showed remarkable powers of observation both of structure and habits, great skill in drawing and especially ingenious and thoroughly practical devices and means of destroying the pests. The reports were models and will never become stale. Darwin wrote in 1871: "There is a vast number of facts and generalizations of value to me, and I am struck with admiration at your power of observation. The discussion on mimetic insects seems to me particularly good and original." In reviewing the ninth and last of these reports, published in 1876, the *Entomologists' Monthly Magazine* of London, remarked: "The author, in giving full scope to his keen powers of observation, minuteness of detail, and the skill with which he uses his pencil, and at the same time in showing a regard for that scientific accuracy—unfortunately too often neglected in works on economic natural history—maintains his right to be termed the foremost economic entomologist of the day." It goes without saying that this prestige existed to the end of his life, his practical applications of remedies and inventions of apparatus giving him a world wide reputation. In token of his suggestion of reviving the vines injured by the Phylloxera by the importation of the American stock, he received a gold medal from the French Government, and he afterwards received the cross of the Legion d'Honneur in connection with the exhibit of the U. S. Department of Agriculture at the Paris Exposition of 1880.

The widespread ravages of the Rocky Mountain locust from 1873 to 1877 had occasioned such immense losses in several States and Territories that national aid was invoked to avert the evil. The late Dr. F. V. Hayden, then in charge of the U. S. Geographical and Geological Survey of the Territories, with his characteristic energy and sagacity, initiated researches on the locust in the Territories. He sent Dr. P. R. Uhler to Colorado in the summer of 1875, and also attached the present writer to the Survey who spent over two months in entomological work in the same year in Colorado, Wyoming and Utah, publishing the results in Hayden's Ninth Report. Mr. Walsh had made important suggestions as to the birthplace and migrations of the insect. Meanwhile Riley had

since 1874 made very detailed studies on the migration and breeding habits and means of destruction of this locust (published in his Missouri State Report for 1876 and 1877). Dr. Cyrus Thomas had also been attached to Hayden's Survey, and published a monograph on the locust family, *Acrididæ*. As the result of this combined work Congress created the United States Entomological Commission, attaching to it Dr. Hayden's Survey, and the Secretary of the Interior appointed Charles V. Riley, A. S. Packard and Cyrus Thomas members of the Commission. Dr. Riley was appointed chief, and it was mainly owing to his executive ability, business sagacity, experience in official life, together with his scientific knowledge and practical inventive turn of mind in devising remedies, or selecting those invented by others, that the work of the Commission was so popular and successful during the five years of its existence. Meanwhile in 1878 while the report of the Commission was being printed, Riley accepted the position of Entomologist to the U. S. Department of Agriculture, and during the season of 1879 and 1880 he investigated the cotton insects, but owing to the lack of harmony in the Department, he resigned, Prof. J. H. Comstock being appointed, and ably filling the position. Congress meanwhile transferred the cotton-worm investigation to the Entomological Commission. Riley was reappointed to the position of U. S. Entomologist in June, 1881. His successor, Mr. L. O. Howard, has stated how efficient, broad and thorough was his administration of this office : "The present efficient organization of the Division of Entomology was his own original conception, and he is responsible for its plan down to the smallest detail. It is unquestionably the foremost organization of its kind at present in existence." Again he writes : "Professor Riley's work in the organization of the Division of Entomology has unquestionably advanced the entire Department of which it is a part, for it is generally conceded that this division has led in most matters where efficiency, discipline and system were needed. Its plan and discipline have been cited by one of the heads of the Department as worthy of imitation by all, and your own honored Westwood, in expressing, in 1883, his admiration of Riley's work, said : 'I am sure it must have had a great share in inducing the activity in entomological work in America, which is putting to the blush the entomologists of Europe.'"

Indeed, so efficient, methodical and painstaking was Riley in whatever he undertook to do that had he been promoted to the position of Commissioner of Agriculture he would have been head and shoulders above any incumbent of that office, and, it is safe to say, would have administered its affairs with practical results far more valuable than those attained by any other Commissioner, as such an office should have been entrusted to a person who had had a scientific education, and not given as a reward for political service. As it is, he was the leader, says Mr. Howard, in many important innovations in the work of the department. His division published the first bulletin, and in *Insect Life* began the system of periodical bulletins, which has since been adopted for the other divisions of the Agricultural Department. He also took a large share in founding the Division of Economic Ornithology, Silk Culture and Vegetable pathology, the first two being placed for some time under his charge. In an address, says Howard, before the National Agricultural Congress, delivered in 1879, in which he outlined the ideal Department of Agriculture, Professor Riley foreshadowed many important reforms which have since become accomplished facts, and suggested the important legislation, since brought about, of the establishment of State Experiment Stations under the general government.

His practical, inventive genius was exhibited in his various means of exterminating locusts, in the use of kerosene oil emulsified with milk or soap, and in his invention and perfection—in which he was essentially aided by the late Dr. W. S. Barnard, who had special charge of the subject of mechanical appliances and remedies while connected with the Entomological Commission and the Agricultural Department, and whose "assistance was fertile from the first," as stated by Riley in his report—of the "cyclone" or "eddy-chamber" or Riley system of nozzles, which, in one form or another, are now in general use in the spraying of insecticide or fungicide liquids.

Although the idea of introducing foreign insect parasites or carnivorous enemies of our imported pests had been suggested by others, Riley, with the resources of his division

at hand, accomplished more than any one else in making it a success. We will let Mr. Howard tell the story of his success, with the efficient aid of Mr. Albert Koebele, in introducing the Australian ladybird to fight the fluted scale:

"One other trait which we have not mentioned is his *persistency in overcoming obstacles.* Nothing daunts him, and the more difficult an end is to attain, so much the more energy and perseverance does he put in its pursuit. A recent instance of this quality we may cite: The fluted scale (*Icerya purchasi* Maskell) has done immense injury to citrus fruit in southern California of late years. Ascertaining that it is kept in check by natural enemies in its native home, Australia, Dr. Riley foresaw the importance of endeavoring to introduce these enemies. Not only did Congress refuse to appropriate money for the purpose, but it refused to do away with a clause in the Appropriation Bill restricting all expenditures to the United States. In this state of affairs most men would have given up the fight; but Dr. Riley, after great trouble, succeeded in accomplishing his end by inducing the Secretary of State to allow the sending of two assistants on the Melbourne Exposition Commission, and through their labors the desired result was reached. Hundreds of specimens of an Australian lay-bird (*Vedalia cardinalis*) were introduced into California, and the dreaded pest is now being speedily reduced to absolute harmlessness. Professor W. A. Henry, of Wisconsin, in a recently-published article, says of this matter, in speaking of the enthusiasm of the people of California over the results of this importation: 'Without doubt it is the best stroke ever made by the Agricultural Department at Washington.'"

It might be thought that all this administrative work of the office and in the field would have left little time for pure science or for much general reading or deep thinking. Let us see what he actually did accomplish in pure science. Riley's scientific writings will always stand, and show as honest work, thorough-going methods, care and accuracy as his office work, and they alone, aside from his practical work, were enough to give him an international reputation. In some of his studies he was probably essentially indebted to his assistants for specimens and aid in rearing them; in others he evidently depended on his own unaided observations and his skill in drawing. He was not "a species man" or systematist as such; on the contrary his most important work was on the transformations and habits of insects, such as those of the lepidoptera, locusts and their parasites, his Missouri reports being packed with facts new to science. His studies on the chronology of all the broods known of the seventeen-year cicada, and its *tredecim* or thirteen-year race, carried on through a long succession of years, will prove of lasting value, having intimate bearings on evolution problems.

His work on the larval characters and hypermetamorphoses of the blister beetles, Epicauta, Macrobasis and Hornia, besides Henous, was thoroughly good and beautifully illustrated by his own pencil. He brings forward in this paper a mass of new facts regarding the triungulin, or first larval stage of these beetles, and those succeeding, which he designates as the Carabidoid, the Scarabæidoid stage, the Coarctate or quiescent larva, these stages preceding the pupa stage. The value of these facts as set forth by so trustworthy and keen an observer, and corroborating and greatly extending those worked out by European observers, is apparent when we consider that the triungulin larva is perhaps the nearest approach to the Campodea-like ancestor of the winged insects, that the Meloidæ are consequently among the most primitive and generalized of Coleoptera, and that from work based on such studies as these of the life-history of this and allied groups there has already resulted the germs of a truer phylogeny or classification of the entire order of Coleoptera. Of similar import are Riley's papers on the larval habits of bee-flies, on the luminous larviform females of the Phengodini and on the first larval stage of the pea-weevil (Bruchus). His studies on the systematic relations of Platypsyllus as determined by the larva evince his patience, accuracy and keenness in observation and his philosophic breadth.

For over twenty years he made observations on the fertilization of Yucca by those remarkable tineoid moths, Pronuba and Prodoxus, and from time to time published papers and notices of progress in his work which culminated in his paper entitled, "The Yucca Moth and Yucca Pollination" (1891-'92), a memoir remarkable for the patient, unremitting work carried on during his spare hours, its thoroughness in dealing with structural details, its critical accuracy, and for its faithful and artistic drawings. It is a paper of interest to botanists as well as zoologists, and of value to the student of evolution. One of his last papers was a continuation and résumé of this subject, entitled "Some Interrelations of Plants and Insects" (1892).

Riley's contributions to the history and structure of the Phylloxera, of the scale insects, of the hop-plant louse, the Pemphiginæ, Psyllidæ, etc., are of permanent interest and value. His best anatomical and morphological work is displayed in his study on the mode of pupation of butterflies, the research being a difficult one, and especially related to the origin of the cremaster, and of the vestigial structures, sexual and others, of the end of the pupa. Whatever he did in entomology was original. He may occasionally have received and adopted hints and suggestions from his assistants, but he laid out the plan of work, supervised every detail, followed up the subject from one year to another, and made the whole his own. His originality in a quite different direction from biology is seen in his paper entitled "Perfectionnement du Graphophone," read before the French Academy of Sciences at Paris, in 1889. He was also much interested in Aëronautics, and took much delight in attending séances of spiritualists and exposing their frauds, in one case, at least, where another biologist of world-wide fame, then visiting in Washington, was completely deluded.

Riley was from the first a pronounced evolutionist. His philosophic breadth and his thoughtful nature and grasp of the higher truths of biology is well brought out in his address on "The Causes of Variation in Organic Forms," as Vice-President, before the biological section of the American Association for the Advancement of Science in 1888. He was a moderate Darwinian, and leaned, like other American naturalists, rather to Neo-Lamarckism. He says: "I have always had a feeling, and it grows on me with increasing experience, that the weak features of Darwinism and, hence, of natural selection, are his insistence (1) on the necessity of slight modification; (2) on the length of time required for the accumulation of modifications, and (3) on the absolute utility of the modified structure." Riley, from his extended experience as a biologist, was led to ascribe much influence to the agency of external conditions, remarking, in his address: "Indeed, no one can well study organic life, especially in its lower manifestations, without being impressed with the great power of the environment." He thus contrasts Darwinism and Lamarckism: "Darwinism assumes essential ignorance of the causes of variation and is based on the inherent tendency thereto in the offspring. Lamarckism, on the contrary, recognizes in use and disuse, desire and the physical environment, immediate causes of variation affecting the individual and transmitted to the offspring, in which it may be intensified again both by inheritance and further individual modification."

The following extracts will illustrate his clear and vigorous style of thought and expression and his attitude on the relations between science and religious philosophy. Regarding the question of design, he says: "Both Lyell and Gray believe in the form of variation having been planned or designed. It seems to me that the evidences of design in nature are so overwhelming that its advocates have an immense advantage over those who would discard it. A fortuitous cosmos is, to most persons, utterly inconceivable, yet there is no other alternative than a designed cosmos. To accomplish anything by a process, or by an instrument, argues greater, not less power, than to do it directly, and even if we knew to-day all the causes of variation, and understood more thoroughly than we do the method of evolution, we should only carry the sequence of causes a step further back and get no nearer to the Infinite or Original Cause."

"Evolution teaches that nothing is yet so perfect but it may be improved; that good comes of the struggle with evil and the one can never be dissociated from the other. The erect position which has given man his pre-eminence has brought him manifold bodily ills. No evolutional sibyl looks to a millennium. Higher development must ever mean struggle. Evolution shows that man is governed by the same laws as other animals." "Evolution reveals a past which disarms doubt and leaves the future open with promise—unceasing purpose—progress from lower to higher. It promises higher and higher intellectual and ethical attainment, both for the individual and the race. It shows the power of God in what is universal, not in the specific, in the laws of nature, not in departure from them."

"The experience gained by those who have reached the highest ethical and intellectual growth must be formulated in precept and principle to be of any benefit to society at large, and the higher ethical sentiment and religious belief—faith, love, hope, charity—are priceless beyond all that exact science can give it."

Riley, an excellent head of a bureau, but sometimes uncomfortable and too independent as a subordinate, at times got into hot water with his superiors in the Department. He was sensitive to criticism, and was somewhat prone to controversy, usually, however, winning in such encounters. Until one came to know him more intimately he was liable to be misunderstood, and by his occasional bluntness made some enemies, but as years rolled on these passing antagonisms melted away.

Vigorous in mind and body, though of late years suffering from overwork, fond of out-door sports, he was a fearless rider on horseback, and an adept with the bicycle, on which, alas, he rode to his death.

His hospitable house at Sunbury was beautified by rare flowers, shrubs and trees, of which he was passionately fond. He was domestic in his tastes, and left a wife and five children to mourn his loss.

Riley left an indelible mark on his time, and the historians of natural science and of agriculture in America will scarcely ignore the results of thirty years of earnest work in pure and applied entomological science.

His scientific honors were well deserved. He was a member of many societies at home and of the entomological societies of France, Berlin, Switzerland and Belgium. He was elected in 1889 an Honorary Fellow of the Entomological Society of London, and was also Honorary Fellow of the Royal Agricultural Society of Great Britain. He was for two years President of the Academy of Science of St. Louis, being the youngest member so honored. He was founder, and for two terms President, of the Entomological Society of Washington, one of the founders of the Biological Society of that city, and an honorary member of the horticultural societies of Illinois, Iowa, Kansas and Missouri. The Kansas State Agricultural College gave him the degree of A.M., and the Missouri State University, in 1873, conferred upon him the degree of Ph. D. He was lecturer on entomology at Cornell University and at other institutions.

A. S. PACKARD.

Brown University.

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TWENTY-SEVENTH ANNUAL REPORT

OF THE

ENTOMOLOGICAL SOCIETY

OF

ONTARIO

1896.

(PUBLISHED BY THE ONTARIO DEPARTMENT OF AGRICULTURE.)

PRINTED BY ORDER OF

THE LEGISLATIVE ASSEMBLY OF ONTARIO.

TORONTO:
WARWICK BRO'S & RUTTER, PRINTERS &c., 68 AND 70 FRONT ST. WEST
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REV. THOMAS W. FYLES, F. L. S.

Member of the Council of the Entomological Society of Ontario, from 1882 to 1888; delegate to the Royal Society of Canada, in 1890, 1894 and 1895; member of the Editing Committee of the "Canadian Entomologist," since 1889.

J. M. Denton.

TWENTY-SEVENTH ANNUAL REPORT

OF THE

ENTOMOLOGICAL SOCIETY OF ONTARIO,

1896.

To the Honorable John Dryden, Minister of Agriculture :

Sir,—I have the honor to transmit to you the Twenty-Seventh Annual Report of the Entomological Society of Ontario. It contains a full account of the proceedings at our thirty-fourth annual meeting, which was held in the city of London, on the 21st and 22nd of October last, for the election of officers and the transaction of the general business of the Society. The report includes the addresses delivered and papers read at the meeting, together with the financial statement of the Treasurer and the reports of the various sections and departments of the Society. Considerable attention is given to the outbreak of the "Army Worm" in this Province, last summer, and the destructive work of the "Tussock Moth" to the shade trees in Toronto, and other papers are submitted dealing with matters of economic and scientific interest in connection with the study of Entomology.

The Canadian Entomologist, the monthly magazine issued by the Society, has now completed its twenty-eighth volume, which will be found to contain a large number of papers of a highly scientific character contributed by the most distinguished students of this branch of science in Canada and elsewhere.

I have the honor to be, Sir,

Your obedient servant,

CHARLES J. S. BETHUNE,

Editor.

OFFICERS FOR 1897.

President	J. W. Dearness	London.
Vice-President	H. H. Lyman	Montreal.
Secretary	W. E. Saunders	London.
Treasurer	J. A. Balkwill	do
Directors:		
Division No. 1	James Fletcher, LL.D.	Ottawa.
" 2	Rev. C. J. S. Bethune, D.C.L	Port Hope.
" 3	Arthur Gibson	Toronto.
" 4	A. H. Kilman	Ridgeway.
" 5	C. G. Anderson	London.
Ontario Agricultural College	Prof. J. H. Panton	Guelph.
Librarian and Curator	J. A. Moffat	London.
Auditors	J. H. Bowman	do
	R. W. Rennie	do
Editor of the "Canadian Entomologist"	Rev. C. J. S. Bethune, F.R.S.C	Port Hope.
Editing Committee	Dr. J. Fletcher, F.R.S.C	Ottawa.
	H. H. Lyman	Montreal.
	Rev. T. W. Fyles	S. Quebec.
	James White	Snelgrove.
	W. H. Harrington, F.R.S.C.	Ottawa.
Delegate to the Royal Society	J. D. Evans	Trenton.
Committee on Field Days	Drs. Woolverton and Hotson, Messrs. Balkwill, Saunders, Anderson, Rennie, Bowman, Elliott and Spencer	London.

ANNUAL MEETING OF THE ENTOMOLOGICAL SOCIETY OF ONTARIO.

1896.

The thirty-fourth annual meeting of the Entomological Society of Ontario was held in its rooms, in Victoria Hall, London, on Wednesday and Thursday, October 21st and 22nd, 1896, the President, Mr. J. W. Dearness, of London, occupying the chair.

The meeting was called to order at 3 o'clock p.m , on Wednesday, when the following members were present: Rev. T. W. Fyles, South Quebec; Mr. H. H. Lyman, Montreal; Mr. J. D. Evans, Trenton; Rev. C. J. S. Bethune, Port Hope; Prof. J. H. Panton, Ontario Agricultural College, Guelph: Messrs W. E. Saunders (Secretary), J. A. Balkwill (Treasurer), J. Alston Moffat (Curator), J. H. Bowman, H. P. Bock, B. Green, W. Scarrow, T. Green, W. J. Stevenson, J. S. Pearce, J. B. Spencer, J. Law, W. Lochhead, W. Percival, and Drs. Woolverton and Hotson, London, and Robert Elliott, Plover Mills. Letters of apology were read from Dr. James Fletcher and W. H. Harrington, Ottawa, regretting their inability to attend the meeting.

At the request of the President the report of the Council for the past year was read by Dr. Bethune.

REPORT OF THE COUNCIL.

The Council of the Entomological Society of Ontario beg to present the following report of their proceedings during the past year:

They have much pleasure in stating that the membership of the Society has been well maintained, and that there has been a gratifying increase in the members from Ontario and an especially large addition in the Montreal branch, from the Province of Quebec.

The twenty-sixth annual report on Economic and General Entomology was presented to the Minister of Agriculture for Ontario, in December last and was printed and distributed at the opening of the session of the Legislature. It contained one hundred and two pages, and was illustrated with thirty-four wood cuts and two full page portraits, one of the late Professor C. V. Riley, the most able and distinguished Entomologist in North America, who had been killed by a fall from his bicycle a few months previously, and the other of Mr. William H. Edwards, author of the "Butterflies of North America," the most valuable and important work of the kind ever published,—both of these gentlemen were honorary members of our Society. In addition to an account of the proceedings at the annual meeting, which included an interesting address on "The New Agriculture," by Mr. C. C. James, Deputy Minister of Agriculture, the volume contains the following valuable papers: "The value of Entomology," by Dr. James Fletcher; "How the Forest in Bedford was swept away," by Rev. T. W. Fyles; "Insect injuries of the year 1895," by Dr. Fletcher; "The growth of the wings of a Luna Moth," "Observations on the Season of 1895," and "Variation, with special reference to Insects," by J. A. Moffat; "Some winter insects from Swamp Moss," by W. H. Harrington; "Birds as protectors of Orchards," by Mr. E. H. Forbush; "The Rocky Mountain Locust and its allies in Canada," by Mr. S. H. Scudder. An abstract was also given of the proceedings of the seventh annual meeting of the Association of Economic Entomologists, together with some of the papers that were of special interest and value to the general reader.

The Canadian Entomologist, the monthly magazine published by the Society, completed its twenty-seventh volume in December last. The numbers of the twenty-eighth volume have been regularly issued at the beginning of each month during the current year; ten numbers, containing 270 pages, have thus far been published, containing a large number of papers of high scientific merit. The series of illustrated articles on the Coleoptera of Canada, by Mr. H. F. Wickham, has been continued and proves of great value to those studying this order of insects.

A fairly complete collection of the important insects of the country is now in the Society's cases. Some new and interesting species have been added during the year.

The most important addition to the library during the year is a complete set of the Annals of the Entomological Society of France. Nineteen other new volumes have been added and catalogued, besides the usual large number of scientific periodicals and exchanges.

The Council desires to express its satisfaction with the careful manner in which the Curator, Mr. J. Alston Moffat, continues to look after the collection of specimens, scientific instruments and library of the Society. Visitors have found him in constant attendance even outside of the hours at which he is expected to be present. Any one, whether allied with the Society or not, seriously studying any phase of insect life, has been cheerfully assisted by him. Farmers, horticulturists, and students bringing their specimens to the rooms in open hours, have thus the opportunity to have such compared with authentic specimens and identified.

The present accommodation which has served the Society since 1881 has become inadequate. Arrangements are being made to obtain new and more commodious quarters in the fine new structure in course of erection by the Young Men's Christian Association of this city.

The reports of the Secretaries of the several scientific Sections printed elsewhere show that, with the exception of the Ornithological one, they have held regular meetings at which useful and interesting lists of subjects were discussed.

The report of the Treasurer is highly satisfactory. The balance on hand, about $530, at the close of the financial year, August 31st, 1896, is larger than usual owing to the fact that some accounts had not then been presented for payment, but the current expenses for the remainder of the year will fully absorb this amount.

The Council desire to place upon record their grateful appreciation of the liberal grant from the Legislature of Ontario, which has enabled the Society to carry on during many years past its scientific and practical work in a manner which would otherwise have been impossible.

The Society was represented by Mr. J. D. Evans, of Trenton, at the annual meeting of the Royal Society of Canada, held in Ottawa, in May last. His report is also presented herewith.

It is with profound regret that the Council record the loss during the past year of two of their colleagues. Mr. John M. Denton, of London, one of the earliest members of the Society, died after an illness of some months on the 24th of March last. He was one of those who originally formed the London branch of the Society, and took a most active interest in it and the parent Society till the close of his life. For five and twenty years he was a member of our Council and did much to maintain the prosperity and usefulness of the Society. His sterling honesty, unfailing courtesy and genial hospitality won for him the respect and affection of all our members. We all deplore his loss as one personal to ourselves, and deeply sympathise wtih his widow in her bereavement.

On the 3rd of April Captain J. Gamble Geddes, of Toronto, died after a few days' illness, brought on by a severe cold. During several years he took an active part in the London branch and held the offices of Secretary-Treasurer, Vice-President and President in succession. After his removal from London he continued to take a great interest in the Society, contributing valuable papers to its publications and holding the position of

Director on the Council for many years. He was a diligent and enthusiastic collector in the order Lepidoptera and gathered together large stores of specimens, most of which are now in the museum of the Geological Survey at Ottawa. His untimely death is a source of deep grief to his colleagues and to a large circle of relatives and friends throughout the Dominion.

The Council desire further to tender their respectful sympathy to Miss Eleanor A. Ormerod, of Torrington House, St. Alban's, England, in her bereavement owing to the death of her sister and life-long colleague and companion, Miss Georgiana Elizabeth Ormerod, who died on the 19th of August last, after an illness of several months duration. The deceased lady was remarkable for her many talents and acquirements as a botanist, a conchologist, an artist, and a linguist, and for her great benevolence and generosity. She assisted her sister very greatly by illustrating her publications, helping in her correspondence and by her unfailing encouragement and wise counsels. She is widely known especially by the series of large coloured diagrams of injurious insects that she published under the auspices of the Royal Agricultural Society of England, and which are found to be of great practical use in illustrating lectures and addresses in this country as well as in Great Britain.

All of which is respectfully submitted.

J. W. Dearness,
President.

Mr. W. E. Saunders presented and read the report of the Secretary.

REPORT OF THE SECRETARY OF THE ENTOMOLOGICAL SOCIETY

FOR THE YEAR 1895-6.

The year 1895-6 has been one of unusual activity to the local members of the council into whose hands the conduct of affairs at the Society's headquarters is placed, but the labors of the Secretary have been reduced to a minimum by the kind and efficient work done by the Librarian and Curator, who has attended to almost all of the work which might otherwise have fallen upon the Secretary. During the early part of the year the council issued a leaflet setting forth the advantage and usefulness of membership in the Society; the said leaflet being for the purpose of enclosure in the correspondence of the members and it is hoped that the influence of the Society will be widened thereby.

Seven council meetings have been called during the year, and three consultation meetings, to which all the local members were invited; for the conduct of business in general, and more especially for that relating to the change of rooms.

The negotiations which had begun at the time of the last annual meeting with the Young Men's Christian Association of this city, for the lease of a room in their new building, have continued throughout the year and have about reached a favorable conclusion, so that unless a hitch occurs, the Society should be occupying the proposed new room in three or four weeks.

The routine work of the Society has proceeded as usual, the meetings of the sections having been regular, except the Ornithological section which did not meet during the year. Particulars of the work of the other sections will be given in the reports by their Secretaries.

Some correspondence has taken place with those in charge of the meeting in Canada of the British Association in which the Secretary has been authorized to pledge the good-will and hospitality of the Society to the visiting members, but the matter of representation at the meeting has been left for the general council to settle at the annual meeting.

All of which is respectfully submitted,

W. E. Saunders,
Secretary.

The Treasurer, Mr. J. A. Balkwill, read the following report of receipts and expenditure for the year ending August 31st, 1896:

REPORT OF THE TREASURER

RECEIPTS, 1895-6.		EXPENDITURE, 1895-6.	
Balance on hand Sept. 1st, 1895	$ 341 91	Printing	$ 571 43
Members' fees	324 54	Report and meeting expenses	159 42
Sales of Entomologist	82 59	Library	37 60
" pins, cork, etc	127 18	Expense account, postage, etc	78 90
Government grant	1,000 00	Rent and fuel	103 05
Advertisements	18 72	Insurance	28 00
Interest	13 40	Salaries	300 00
		Pins, cork, etc	99 01
		Balance on hand, August 31st, 1896	530 93
	$1,908 34		$1,908 34

We the Auditors of the Entomological Society of Ontario hereby certify that we have examined the books and vouchers of the Treasurer, and find them well kept and correct, and that the above is a true statement of the accounts of the Society.

JAS. H. BOWMAN,
W. T. MCCLEMENT, } Auditors.

Mr. Balkwill explained the several items of expenditure and stated that the balance on hand would all be absorbed in printing and other expenses before next year's subscriptions came in. The President in accepting the report, commented on the loss the Society had sustained through the removal of Mr. McClement, who has been appointed Lecturer in Chemistry in the Armour Institute at Chicago.

Mr. J. A. Moffat presented and read his report as follows:

REPORT OF THE LIBRARIAN AND CURATOR

FOR THE YEAR ENDING 31ST OF AUGUST, 1896.

The number of volumes added to the Library during the year was nineteen of which nine were exchanges bound for the Society; the others being received from various sources, already bound.

The most important of these were

The Missouri Botanical Garden.

The Year Book of the U. S. Department of Agriculture.

The Report of the N. Y. State Entomologist: Dr. Lintner.

The Report of the Gypsy Moth Commission.

The Proceedings of the Royal Society of Canada.

The Fifteenth Annual Report of the U. S. Geological Survey.

Acknowledgement is due to John Hamilton, M.D., Allegheny, Pa., for two volumes of his Coleoptera papers.

The whole number of volumes on the Library register is now 1,418.

A full set of the annals of the "Entomological Society of France," was obtained, in exchange for a full set of the publications of the Entomological Society of Ontario.

The number of volumes issued to local members was seventy-three.

But slight addition was made to the Society's native collection during the year; most of the new material obtained being yet undetermined.

Respectfully submitted,

J. ALSTON MOFFAT,
Librarian and Curator.

Dr. Bethune moved, seconded by the Rev. T. W. Fyles, that the Annals of the Entomological Society of France, and such other volumes as may be decided upon by a committee to be appointed by the President, be bound.—*Carried.*

By instruction of the local members of the council, the Secretary brought up the question of cataloguing the books in the Society's Library by the London Free Library Board as an addendum to their reference list. After some consideration of the subject, it was moved by Mr. W. E. Saunders, seconded by Mr. J. D. Evans, that this Society views with favor the proposition of the Free Library Board to publish a list of the books belonging to the Society in their catalogue.—*Carried*

The Secretary called the attention of the meeting to the importance of having the Society represented at the meeting of the British Association, which is to be held in Toronto next year, It was thereupon moved by the Rev. T. W. Fyles, seconded by Mr. Evans, that the President and Editor be, and are hereby, appointed to represent the Entomological Society of Ontario at the meeting of the British Association for the Advancement of Science, to be held in Toronto in 1897, and that the President be authorized to appoint additional representatives at his discretion.—*Carried.*

Mr. J. D. Evans then read his report as delegate to the Royal Society at its meeting in Ottawa in May, 1896, as follows:

REPORT FROM THE ENTOMOLOGICAL SOCIETY OF ONTARIO TO THE ROYAL SOCIETY OF CANADA.

As the representative of the Entomological Society of Ontario, I have the honor to submit a brief report of its proceedings and work during the past year.

It gives me much pleasure to be able to report that the membership continues to increase and is now much larger than ever heretofore, and that interest in its work is still unabated.

Valuable additions have been made to the Library and Collection of Insects—the number of volumes thus added being thirty-eight, making the total 1,399 volumes.

The Canadian Entomologist, the official organ of the Society, although not numbering quite so many pages as in the year previous, is yet largely increased beyond former years.

During the year 1895 it completed its twenty-seventh volume of three hundred and fifty-eight pages. There were forty six contributors, of whom twenty-nine were from the United States, three from England, and one from Germany—and of the remaining thirteen (Canadian) it is pleasing to be able to state that five of them were from the newer provinces west of Lake Superior. These contributed in the aggregate 160 articles in which were described 109 new species and seven new genera.

Among the more important papers published during the year may be mentioned the following:

The Coleoptera of Canada—Mr. H. F. Wickham, which ran through eight numbers.

Canadian Coccidæ—Mr. T. D. A. Cockerell.

Preliminary Studies in Siphonaptera—Mr. Carl F. Baker, which appeared in seven numbers.

Variation in Nemeophila Petrosa at Laggan in Western Alberta—Mr. Thos. E. Bean.

Synopsis of the Dipterous Genus Phora—Mr. D. W. Coquillett.

Mounting Insects without pressure—Mr. R. W. Rennie.

The Coleoptera collected at Massett, Queen Charlotte Island, B.C.—Rev. J. H. Keen

Descriptions of the Larvæ of certain Tenthredinidæ—Mr. Harrison G. Dyar.

Notes upon the North American Saturnina, with List of the Species—A. Radcliffe Grote, A.M.

Butterflies of Southern Manitoba—Mr. E. F. Heath.

The Larvæ of the North American Saw-flies—Mr. Harrison G. Dyar.

The Life-history of Pamphilia Manitoba, Scud—Rev. Thos. W. Fyles.

To the aforementioned articles should be added also the numerous book notices of current publications of entomological literature, correspondence, obituary notices, etc,

In addition to the Monthly Magazine the Society publishes an Annual Report to the Department of Agriculture of the Province of Ontario, the twenty-sixth of which was issued in 1895, which consisted of 102 pages with numerous illustrations ; in this is given a very full report of the thirty-third annual meeting of the Society, which was held in their rooms in London, on Wednesday and Thursday, the 27th and 28th of November, 1895. An important feature of the annual meeting was an open meeting on the evening of Wednesday, in the City Hall, at which His Worship the Mayor presided and Prof. C. C. James, Deputy Minister of Agriculture of Ontario, delivered a very exhaustive and interesting address on "The New Agriculture," which was followed by Mr. James Fletcher with a very instructive address on "The Value of Entomology."

The annual report also contains the following papers :

How the forest in the District of Bedford was swept away—Rev. Thos. W. Fyles.

Insect Injuries of the year 1895—Mr. James Fletcher.

The growth of the wings of the Luna Moth—Mr. J. A. Moffat.

Observations on the season of 1895—by the same author.

Variation with special reference to Insects—also by the same author.

Some winter insects from swamp moss—Mr. W. Hague Harrington.

Birds as protectors of orchards—Prof. E. H. Forbush, Ornithologist of the Massachusetts Board of Agriculture.

The Rocky Mountain Locust and its allies in Canada—Mr. Samuel H. Scudder.

The reports of the Botanical, Geological and Microscopical Sections of the Society.

The report of the Montreal Branch.

The report from the Entomological Society of Ontario to the Royal Society of Canada.

And also a very full report of the proceedings of the seventh annual meeting of the Association of Economic Entomologists.

The Botanical Section reported that regular weekly meetings had been held during several months, at which the attendance was much in advance of previous years. Several papers had been read at the diffeient meetings. One public field day was held at which much enthusiasm was manifested.

The Geological Section reported as having had a most prosperous year. The membership had increased, and average attendance at meetings was greater. A number of valuable papers have been contributed, and several very successful trips made to places of geological interest.

The Microscopical Section reported as having a number of very successful meetings at which a number of interesting subjects were presented.

The Montreal Branch presented their twenty-second annual report shewing a number of meetings held at which excellent papers were read, and the membership increased.

J. D. Evans,
Delegate.

REPORT OF THE MONTREAL BRANCH.

Mr. H. H. Lyman read the following report:

The twenty-third annual meeting of the Montreal Branch was held in the library of the Natural History Society, on Tuesday evening, 19th May, at 8.15 o'clock.

Members present: Messrs. H. H. Lyman, President; A. F. Winn, Vice-President; G. Kearley, G. C. Dunlop, Dr. Wyatt Johnston, E. A. Norris, J. B. Williams, E. T. Chambers, T. D. Brainerd, H. Brainerd, G. H. Moore, and Lachlan Gibb, Secy.-Treas.

The President presented the following report of the Council:

Report of Council.

In presenting their twenty-third annual report the Council have much pleasure in referring to the increased prosperity of the Branch, especially in regard to the large number of new members who have joined during the year.

Since our last annual meeting eleven new members have been added to our roll, but we have to deplore the loss by death of Mr. E. M. Gibb, who had only joined the Society during the previous year.

During the year eight meetings have been held, and the following papers and communications were read:—

The Life history of Pamphila Manitoba—Rev. T. W. Fyles.

Note on the occurrence of Ællopos Titan—A. F. Wynn.

Notes on the season of 1895—H. H. Lyman.

Notes on the life history of Colias Interior—H. H. Lyman.

Description of the egg and young larva of Cerura Borealis—H. H. Lyman.

Notes on Trychosis Tunicula-rubra—Rev. T. W. Fyles.

Notes on the preparatory states of Erebia Epipsodea—H. H. Lyman.

The Importance of Entomological Studies to our Agricultural and Fruit Growing communities—Rev. T. W. Fyles.

Prairie and Mountain Plants—James Fletcher.

The larger Species of Argynnis and the Mystery of their Life History—H. H. Lyman.

During the season a course of short lectures to young people was inaugurated by the Natural History Society with the active assistance of our Branch. The lectures were delivered in the Society's lecture hall on Saturday afternoons, and it is hoped that they will have some beneficial effect in interesting some of the young people in natural history studies.

The Branch is under great obligations to the Natural History Society for the recognition extended to it as an affiliated society or section, such recognition carrying with it the valuable privilege of the free use of their rooms for our meetings when desired, while we retain unimpaired our connection with the parent Society in London.

The Council would recommend that all books belonging to the Branch should be inscribed with our name and placed in the Natural History Society's library on the understanding that we remain the owners of them, and that our members have free access to them.

The Treasurer's report shews that the finances of the Branch are in a healthy condition, and the Council would recommend to the new Council the advisability of considering how the surplus may be expended for the interest of the Branch.

Respectfully submitted on behalf of the Council.

H. H. Lyman,
President.

The Treasurer submitted his report, and it was moved by G. C. Dunlop, seconded by G. Kearley, That the reports of the Council and the Secretary-Treasurer be received and adopted. Carried.

The following officers were elected for the ensuing year:

President—H. H. Lyman.

Vice-President—A. F. Winn.

Secretary-Treasurer—Lachlan Gibb.

Council—G. C. Dunlop, G. Kearley.

The President then delivered his annual address in which he dwelt upon the necessity of more of the members taking an active part in preparing papers and sustaining the interest of the meetings. He also drew attention to some of the problems in connection with the Lepidoptera which awaited solution, some of which the members ought to be able to get some light on during the season.

Mr. G. Kearley, in moving a vote of thanks, suggested that the list of problems should be printed and a copy sent to each member.

The meeting then adjourned.

LACHLAN GIBB,
Secretary.

ANNUAL ADDRESS OF THE PRESIDENT OF THE MONTREAL BRANCH.

GENTLEMEN,—In most societies it is usual for the President to deliver an annual address at the annual meeting and this custom can, I think, be adopted in our Branch without disadvantage.

From the reports of the Council and of the Secretary-Treasurer it can be seen that the Branch has had a reasonably successful season, in regard both to the number of papers read and to the large number of new members who have joined us.

There is one point, however, to which I would earnestly invite your attention and that is that the labour of providing papers for the meetings is left too much to the President and I feel that I do not receive the assistance in keeping up the interest of the meetings that any President has the right to expect from the members.

With the single exception of Mr. Winn's "Note on *Aellopos Titan*" read at the October meeting, all the papers were contributed by me or secured by me from outside friends like Mr. Fyles and Mr. Fletcher.

It seems to me that every member might do something to contribute to the interest of the meetings.

The simplest paper upon anyone's experience would at least do something to relieve the annual report of the monotonous repetition of my name as the contributor of papers.

Subjects of discussion might be suggested and genera or groups taken up and systematically studied, the members bringing together all their material in these genera and verifying determinations, studying up the generic characters and so learning why a particular species is placed in a particular genus.

I doubt if any of our members can tell in what a *Neonympha* differs from a *Satyrus* or an *Erebia*, or a *Phyciodes* from a *Melitæa*. Then more interest might be shown in bringing specimens to the meetings. Specimens do not need to be rare in order to be worth showing. Well-set specimens in fine condition of even the commonest species are always a pleasure to look at, and it would at least show that the members were actually collecting specimens.

Further, I hold that every true entomologist should be something more than a mere collector of specimens. We should all seek to do some original work, no matter how little, in the field that we study.

A great temple of knowledge of scientific truth is being built up by the workers in all departments of science, in all lands, and through all the centuries and we should all strive to bring at least one stone, well cut and true, to build into this great temple.

There are many interesting questions awaiting solution and some of us ought to be able to do something towards elucidating some of them. To mention a few among the butterflies, *Danais Archippus:* How early does this species appear here? Is it ever seen before the end of June? Is there a second brood? Scudder thinks not in the north.

Argynnis Cybele. For this species my paper read at the last meeting is a sufficient indication of points that require elucidating and I should be very grateful for any assistance, particularly for the donation of living females as early as obtainable.

Argynnis Myrina. Why is the emergence of this species spread over so long a time as described by Scudder? Are there three broods here?

Melitæa Phaeton. This species is attacked by a Pteromalid parasite which has not been determined and its life history is unknown, though there is some reason to believe that it passes two years before completing its cycle, is this the case? I greatly doubt it.

Of *Grapta Comma*, Scudder writes that "careful statements of its comparative abundance are needed from all parts of Canada, before its geographical distribution can be fully understood." It is attacked by an unknown Dipterous parasite which should be determined.

Grapta Progne. Does this species feed on elm as stated by Harris? How late in the spring do the hibernators fly? When does the summer brood appear, become abundant, and disappear?

Eugonia J-Album. So little is known of this species that notes of every kind are desirable. Is there more than one brood? Why are there more individuals late in August and September than earlier? How long does it continue on the wing?

Vanessa Antiopa. When does the first brood of the season appear here? When the second? Does it ever hibernate as a chrysalis?

Limenitis Disippus. How many broods are there in this locality?

Satyrus Nephele. Is it subject to attack by any parasite?

Neonympha Canthus. Has it any parasites?

Neonympha Eurytris. Is there a second brood or part of a brood here? If so how does it compare in numbers with the first? Are there any parasites?

Pieris Oleracea. How many broods are there? Why has it so generally disappeared before *Pieris Rapæ?*

This last question is one which might puzzle any scientific man even of the first rank. Still there must be some reason for it and any of us might stumble on it.

Is it possible that *Oleracea* was comparatively free from parasitic attacks before the advent of *Rapæ* which is preyed upon by many species and that some of the latter's enemies have turned their attention to the former?

Our meetings are now closing and field work should begin. Will not the members strive to have something of interest to tell or show when we again begin our meetings in the autumn.

The branches other than Lepidoptera and Coleoptera, are sadly neglected. Can we not do something to work up our local forms of the Neuroptera, Orthoptera, Hymenoptera, Diptera, and Hemiptera?

H. H. Lyman.

The following paper was then read :

NOTES ON THE SEASON OF 1896.

BY THE REV. THOMAS W. FYLES, F. L. S., SOUTH QUEBEC.

For half of the year Quebec seems to be the very throne of the ice king. The winters are long, and, in them, the storms are frequent, and the frosts severe. This spring people were crossing the St. Lawrence on the ice till St. George's day (April 23rd). When the "bridge" broke up a school-girl and one or two other persons were taken from the floating masses in canoes. Frost and snow come upon us in the end of October. The season then for out door Entomological work is a brief one—little can be done before the first of May, and but little after the end of September.

The fancy of the English Entomologist in Canada, must often revert with regret to his experiences in the old country—to his early spring work at the sallows, and his late captures at ivy bloom—to his welcome of *Gonepteryx rhamni* in February, and his farewell to *Pœcilocampa populi* in December.

To those who make a practice of rearing insects there will, even in the winter months, be occurrences of interest. Thus, early in the year on examining some cocoons and chrysalids that I had in the house, I found that a fine specimen of *Trogus fulvipes*, Cresson, had made its exit from a pupa of *Papilio Turnus*, Linn.

From a jar of earth in which a batch of larvæ of *Deilephila chamœnerii*, Harr. that had fed on *Epilobium coloratum*, Muhl, had buried themselves, I obtained—not the moths I expected, but—a number of two-winged flies of the species *Masicera anonyma*, Riley. The maggots of this species had destroyed the larvæ of the moth.

Our long winters afford us many opportunities for going over our summer captures, for identifying them and placing them in their proper order. And here I would record the capture at Sherbrooke, on the 25th of May, 1895, by the Rev. Abbe Begin, of that very rare and elegant butterfly *Thecla læta*, Edw. It was sent to me in February of this year for identification.

The following is a description of it :

THECLA LÆTA, *Edwards*, (Male).

Colour above :—Black with a purple blush. Near the hind margin of the secondaries are three ultramarine patches, with a black reniform spot near the outer edge of each.

Colour beneath :—Ash grey approaching to brown with a slight blush of purple on the primaries. Towards the hind margin of these there is an indistinct line, with a touch of light red near the upper part of it.

On the secondaries there is an irregular, but curved, row of light red spots, each with an *outer* edge of white. Near the outer angle there are three other such spots with the *inner* edge of white.

One of our earliest species is *Brephos infans*, Moesch. It is found in the birch woods around Montreal, while the snow is yet on the ground. I have not found the species in this neighbourhood though I have often searched for it.

It is a common saying at Quebec, "We have no spring." Summer seems to burst upon us all at once. This year on the 19th of April the swallows came ; on the 21st flocks of ground-birds appeared ; on the 26th the first hibernated butterfly shewed itself.

The first caterpillars to appear openly are the "Woolly Bears." Full grown specimens of *Phragmatobia rubricosa*, Harr. may be seen in April, shuffling over the snow. In colour they are soft seal brown, slightly darker towards the head. The head is black and shining, and the feet are reddish brown. The specimens I have taken have not seemed inclined to feed, but have soon spun themselves up. Their cocoons have been light, and have had the larval hairs entangled in the meshes.

There is usually a space under the snowbanks, in the spring, caused by the warmth of the earth, and in this space vegetation commences. The creatures therefore may have fed up before they appeared upon the surface.

Among the immature larvæ that shew themselves in the early spring are those of *Euprepia caja*, Linn. On their first appearance at that season they are black, and about three fourths of an inch in length. They crawl out upon the side-walks, and upon the floors of out-buildings.

Some years ago I brought a batch of this species from the egg to perfection. They hibernated—if I remember rightly—after the second moult.

In the spring of 1891 I collected some larvæ of like appearance and habits, thinking I would raise a few more specimens of the moth. These larvæ moulted on the 4th of May, and shewed a broad side-line of red hairs, so I knew that I had been mistaken in supposing them to belong to *E. caja*. They again moulted on May 20th. On emergence from the old skins the heads and legs of the larvæ were honey-yellow, but they soon changed to jet black. On the 17th of June after having drawn, in every instance, a few leaves together for a tent, they went into chrysalis without spinning a cocoon. The chrysalid was blue-black with a bloom like that of an Orleans plum. The larval skin remained attached to the extremity of the chrysalis case. On July 10th the perfect insect appeared. It was *Arctia virgo*, Linn.

Speaking of larvæ, I would tell of the strange winter-quarters of a caterpillar of a noctuid which I found early in the year. The year before I had obtained a specimen of that very rare hymenopterous parasite, *Sphecophagus prædator*, Zabriskie. From its position when I found it, I judged that it must have come either from a nest of *Vespa media*, Oliv., or from a mud castle of *Pelopeus cementarius*, Drury, both of which I was keeping in a window of my study. Hoping to obtain more specimens of Prædator, I collected in the winter all the wasps' nests I could. Snugly coiled up in a cell of one of those brought to me was the larva I am telling of. It became active in the warmth of my room, but I had nothing among my house-plants that it would feed upon, and it soon perished.

May the 1st was a bright, cold day. Frogs were croaking amid the broken ice and masses of snow in the pools, and large banks of snow lay in the woods. The poplars, birches and alders were in catkin, and the leaf-buds of the red elder (*Sambucus pubens*, Michx.), *near the ground*, were opening. On this day I saw on the sunny side of a stem a specimen of *Vanessa Antiopa*, Linn., bright in colour, and without a flaw.

After the 1st of May vegetation progressed by leaps and bounds, and insect appearances multiplied. By the 13th such delicate forms as *Lycæna marginata*, Edw., *Nemoria gratata*, Walker, *Rheumaptera intermediata*, Gn., etc., were on the wing. On this date I saw a pair of *Osmia proxima*, Cresson, *in coitu* resting upon willow catkins. At the same time larvæ of *Pædisca saligneana*, Clemens, which had remained through the winter enclosed in webs within their galls on Solidago, left their domiciles and buried themselves in the soil. The imagos appeared on the 30th of May.

On the 15th of May a specimen of *Feniseca Tarquinius*, Fab., appeared in my breeding-cage. As the chrysalid had been out of doors all the winter this marks the date of appearance of the early brood of the species.

Lobophora angulineata, Grt., was common on the bolls of spruce trees on the 19th, and on the 21st *Lobophora atroliturata*, Walker, appeared.

On the 20th a full grown larva feeding upon choke cherry (*Padus Virginiana*, L.) was brought to me. The next day it buried itself and went into chrysalis. The following is a description of it: Length an inch and three quarters. Head, rather small, brown. Body plump and smooth. Colour, light drab. Spiracles outlined with dark brown. Just above them is a dark brown narrow side-line. On each segment a transverse dark brown line runs backward to a sub-dorsal line of lighter brown. On each segment along the back and pointing backward is a light brown V-like mark, with a pale patch on each side of it.

The larva could not have attained its growth in the fortnight in which the choke-cherry had been in foliage—it must have hibernated.

The buried caterpillar made a cyst strengthened by a slight web. The chrysalis was very dark glossy brown, and had a terminal spine. The moth appeared on the 27th of June, and proved to be *Mamestra imbrifera*, Guen.

The beautiful larvæ of *Phyciodes Harrisii*, Scudder, were common on the white aster (*Diplopappus umbellatus*, Tor. and Gr.), on the 21st of May and till the end of the month.

On the 6th of June I went to "The Gomin." In the fact that I knew no place there in which to sit down lay the chief discomfort of my first visits to this swamp. Fortunately in one of my rambles I discovered a huge solitary boulder half imbedded in the spongy soil. Now I am sure of a resting-place whenever I can find leisure to visit the swamp. I can sit or recline at ease on this stone, which surely some benevolent genie, anticipating the needs of weary naturalists, deposited far away from its original matrix.

Seated upon this stone that 6th of June I looked round upon the scene. Before me, some hundreds of yards distant, was the one tall pine, my landmark and guide to exit from the swamp. Around extended the level reaches of sphagnum, forming a vast amphitheatre bounded with tamarac and spruce. The surface of this area was beautified with innumerable blossoms. The prevailing colour was rose, from the lovely blossoms of *Rhodora Canadensis*, L., and *Kalmia angustifolia* L., but this was relieved by the white tufts of cotton-grass, *Eriophorum polystachyon*, L., and the clustered blossoms of the *Ledum latifolium*, Ait. The pitcher-plant, *Sarracenia purpurea*, L., lifted here and there its tall stalks, each surmounted by a yet unopened bud and resembling the maul-stick of the painter, and here and there the handsome blossoms of *Cypripedium acaule*, Ait., appeared.

In this solitude, seated upon my chair of state, I could almost fancy myself the monarch of all I surveyed, but thoughts of the kind were dispelled when I saw a *habitant* approaching. I noticed a peculiarity in this man's gait—he lifted his knees like a high-stepping horse, as he made his way through the yielding sphagnum. The motion struck me as grotesque; but soon afterwards, on moving away, I found myself making progress through the swamp in the same absurd fashion. I suppose it to be the mode of progression natural to the case.

As the man passed there now and then arose, disturbed by his approach, a specimen of that handsome chestnut-coloured moth *Epirranthus obfirmaria*, Hbn., or one of *Ematurga faxonia*, Minot, or one of *Chionobas Jutta*, Hübner.

Speaking of Jutta, I lately found among my papers a description of that butterfly written by a former member of this society, whose memory is dear to many of us—Mr. G. J. Bowles. I give it as a memento of our departed friend:

"*Chionobas Jutta*, Hübner. Lighter brown than Nephele, 3 eyelets in each fore-wing, centre one smallest, 4 or 5 on each hind-wing, the one at anal angle largest. All the eyelets are small in size. Beneath, markings of fore-wings are repeated. Hind-wings marbled with brown and light grey, one eyelet near anal angle."

On June 10th, I took a pair of *Dolerus Aprilis*, Morton, among young spruce trees on Levis Heights.

On June 11th, a specimen of *Cerura cinerea*, Walker, burst from a cocoon that had been sent to me by a friend. This cocoon had been cut out from the boll of a poplar. It seemed to be formed of very fine woody particles cemented together into a case so hard that one might wonder how the insect could break from it. Examination showed that at the point of rupture the case was very thin. Besides *C. cinerea* I have taken, in Quebec province, *C. borealis*, Boisd., *C. scolopendrina*, Bdv., and *C. multiscripta*, Riley, the last named at Cowansville.

On the 15th June I saw several specimens of that handsome beetle *Rhopalopus sanguinicollis*, Horn, escaping from their tunnels in the stem of a red plum tree. They left oval openings large enough to allow of the insertion of a medium-sized goose-quill.

On the 24th of July I found full-grown larvæ of *Zarea Americana*, Cresson, feeding upon buck bean, *Menyanthes trifoliata*, L. I find this species every season in the same spot, and only in that spot. The larva has the habit of curling itself round with the head on the outside. The following is a description of it:—Head black and shining, a lighter shade just above the mandibles. Eyes protuberent, glossy black. The back of the larva is lead colour, inclining to blue. The second segment near the head and the anal segment are paler. Along the back are eleven cross-bars, formed of a central black spot with an oblong patch of yellow on either side, terminated on either side with another black spot. Between every pair of these bars are two cross lines of smaller black and *pale* yellow dots. Along the edge of the lead colour on either side is a row of eleven conspicuous black dots. Below it is a broad yellowish-white spiracular line. The spiracles are small and black. Underneath them is a row of deep yellow warts each surmounted with two black dots. On the underside the larva is yellowish-white. The true legs are tipped with black.

I do not know the larvæ of *Abia Kennicotti*, Norton. There are two specimens of the fly in the Provencher collection. The differences between the imago of this species and that of *Z. Americana* are these: Kennicotti is smaller than Americana. Its colour is black with a tinge of green, whilst that of Americana is brown with a tinge of fuscous. Kennicotti has a distinct mark like a reversed Y, extending from the costa to the inner margin of the fore-wing. In Americana this wing mark is confused. The costal line and the venation of the fore-wings in Americana are heavier and more distinct than those of Kennicotti. The abdomen in Americana is somewhat spatulate; in Kennicotti it is rounded. The underside of the abdomen in Kennicotti is black; in Americana it is fuscous.

During the month of August pressing duties and frequent journeys hindered me from giving attention to entomological pursuits. This was unfortunate, for in one of my times of absence I lost a brood of young larvæ of *Hepialus argenteomaculatus*, Harris, which had come from eggs sent me by Mr. A. F. Winn. These eggs were round and black, and under the microscope resembled grapes. In the hatching they were ruptured irregularly. The young larvæ appeared in the last week of August. They were one-tenth of an inch long. The head was disproportionately large—suggestive of a boring habit. It was brown, and there was a brown shield on the second segment. The body was yellowish white, warty, and set with long hairs. The fore-legs were brown.

In September may be found in the leaves of the Golden Rod (*Solidago Canadensis, L.*) eye-like spots, yellow in the centre with a surrounding of reddish brown. Osten Sacken made a guess at the insect producing these, and named it *Cecydomyia carbonifera*, from the black substance, not unlike charcoal that is found in the galls. For several years I endeavored to raise the fly without success—I think for the reason that I did not collect the blistered leaves early enough. I am under the impression that the larvæ of the fly abandon the leaves, and undergo the pupal change in the herbage or the soil. The parasites of the species remain in the leaves. I raised two kinds of these in abundance, viz.: *Torymus Sackenii*, Ashmead and *Polygnotus solidaginis*, Ashmead. The first named, as seen under the microscope, is a marvel of grim beauty—a polished gem, glowing with crimson, green and gold. The latter is of more sober hue. It is admirably described by Mr. Ashmead in his monograph of the Proctotrypidæ, p. 307. The cocoons of the species may be found in the blisters, three or four in a cluster.

This year I think I have succeeded in raising the original cause of the gall. It is a *Sciara* closely allied to *S ocellaris*, Coms. The following is a description of it: Expanse of wings, two-tenths of an inch; length of body, one-tenth; length of antennæ, one-twentieth. Hairy, of a uniform light brown; head rather small; eyes reniform; antennæ, 14 jointed; mouth organs large; thorax large, rotund; abdomen long, attenuated; wings rather dusky—a peculiar loop in the venation; halteres, club-shaped.

While speaking of Hymenopterous parasites, I should like to express my admiration for the work among the Hymenoptera that is done at Washington by Mr. Howard and his *confreres*.

Mr. Howard's bulletin on the Joint-worm Flies, for its grasp of the subject, its clearness of description, and the beauty of its illustrations is a model work. Mr. Marlatt's NEMATINÆ is also first-class—excellent in every way. Of Mr. Ashmead's PROCTOTRYPIDÆ I can say, that the more I study it, the more I marvel at the amount of care and research that it betokens. It is a very mine of information.

I have said above that I wanted to obtain wasps' nests for a special purpose. Sometimes wasps' nests are plentiful enough. This season there has been a scarcity of them, from the nests of *Vespa maculata*, Fab. downwards.

Here is a story of a wasp's nest: Two Irishmen were working in the woods one day. One called to the other, "Pat, here's a bees' nest in a blather, let us take the honey!" "And sure," said Pat, telling the story afterwards, "there was more cry than honey; and the cry was from Terence."

A short time since I was at a village in the eastern townships; and a farmer I there called upon reminded me of a circumstance that occurred thirty years ago. At that time I was on a visit to a friend for whom this man was then gardener. He was troubled about a colony of wasps that had suspended their nest in the centre of the ceiling of the carriage-house. He was "afraid to burn it, and afraid to crush it." What could he do? "Meet me at night fall," I said "with a pair of steps and a lantern; and I will take it for you." At the time appointed I went, taking a cork, and a small bottle of chloroform in my pocket. I placed the steps under the nest, whilst the gardener held the lantern at a respectful distance. Having mounted the steps I deftly slipt the cork into the hole at the bottom of the nest, and then poured a teaspoonful of chloroform upon the top of the insect habitation. It immediately soaked through the paper covering; and then there was a great commotion within; but in a few moments all was still I cut the nest from the ceiling with my pen-knife and brought it down in my hand. "Well," said the gardener, "that was neatly done!" And he has remembered all these years *the way to take a wasps' nest.*

On the 10th of this month I went to the St. Henri woods. *Colias Philodice*, Gdt. and *Chrysophanus Americana*, D'Urban, were on the wing. Besides them a few locusts and crickets, two noctuids out of reach, a two-winged fly (*Sericomyia militaris*, Walker), and a beetle (*Necrophorus tomentosus*, Web.) were all the perfect insects I saw.

I found larvæ of *Aulax nabali*, Brodie, in the stalks of the Wild Lettuce, *Nabalus altissimus*, Hooker, a foot, or so, from the ground. They were feeding in the white, downy lining of the stalk, and in some instances had commenced their cells or cocoons which as the stalk dries up will stand out in the hollow like bulblets, the size and shape of grains of hemp. Some years ago I exhibited cocoons of the species at one of our meetings. The perfect insects came from them early in the year following.

I have taken many a walk and examined many a tamarack in the hope of finding cocoons of *Platysamia Columbia*, Smith, a species that was taken at Quebec by Mr. Bowles. Some years ago I found a vacated cocoon of the species. I greatly fear that *Nematus Erichsonii* by stripping its food trees has banished this fine species from the locality.

SOME INSECTIVOROUS MAMMALS.

BY ROBERT ELLIOTT, PLOVER MILLS.

Under the above heading I would like to treat in a popular way of a group of animals which, on account of their food habits, have a more or less direct bearing on the science of economic entomology.

Three orders—namely, *Cheiroptera* (Bats), *Insectivora* (Moles and Shrews) and *Carnivora*, represented by such non-typical forms as the Raccoon and the Skunk—include all of our own species which deserve the apellation "insectivorous mammal."

Unfortunately the term "insectivorous" as applied to a bird or a mammal seems to imply that the food of the species in question is in some way necessarily confined to what we call injurious insects. As a matter of fact little or no discrimination between beneficial and injurious insects has been ascertained as being made by any of our mammals in the choice of their food.

A skunk, foraging through the damp and shady wood, will, on finding one, munch a golden Calosoma with the same avidity that it crushes a May beetle. Most of our terrestrial insects, good and bad as we classify them, are no doubt held to be invariably good by the hungry shrew lucky enough to capture them. From the bat point of view, the *raison d' être* of night flying insects is quite likely enough considered simply as an essential requirement in order to keep the old and exclusive bat family in its proper position at the head of all living things. Nevertheless much good may be done without conscious discrimination; the farmer may derive a benefit from an act performed by a creature not dreaming of his existence. If it can be shown that the despised bat, the misunderstood shrew and the persecuted mole, from an economic point of view, "do good by stealth and blush to find it fame," it may be accepted as sufficient justification for the appearance of this paper in the pages of an entomological report.

THE BATS.

The Bats, as an order, are very distinct from any other mammalian group. The most casual observer recognizes these uncanny-looking noctural swallows as simply *flying mammals*, and thus far no other mammals than bats have been found adapted for true flight.

Their relationship to other groups has never been clearly elucidated. No scientific explanation of their origin is afforded by the investigation of their fossil remains. In short any fossil hitherto discovered has been either all bat or no bat at all. While they are thus easily separated from all other groups, when we come to the consideration of how many species we have, the greatest difficulties are at once encountered.

In previous reports of this Society our able Curator, Mr. Moffat, has put with force the pertinent query, "What constitutes a species?"

That this question presses with peculiar force on any one attempting the classification of our bats is admitted by that eminent authority, Dr. Harrison Allen, from whose monograph—"The Bats of North America"—I quote, "The difficulties acknowledged in identifying the American species (*Vespertilio*) are apparently innumerable, so great is the range of variation in the proportions of the ears, thumbs, feet, tail and phalanges of the manus and in the coloration of the fur and the membranes. If the purposes of zoological science should end with the identification of species, the student might well be discouraged in his studies in this field. But, fortunately, the very intricacies of the subject suggest problems in the attempts to solve which his knowledge of the life and structure of these little organisms cannot fail to be increased."

Owing to the courtesy of W. E. Saunders, Esq., I have had the opportunity of making an extended study of a series of bats collected by him, chiefly in the vicinity of London. As I feel quite unable with the space at my disposal to give a non-technical description that would prove of practical value, I simply give a list of species with short notes on their distribution, etc.

All our species belong to the family *Vespertilionidæ*, are pre-eminently insectivorous and apparently hold the same relation to the night-flying insects that our swallows do to those insects which fly by day.

1. *Vespertilio gryphus* (Fr. Cuvier), The Little Brown Bat. Five specimens. One of our commonest species, ranging in different forms from the north-eastern United States to Hudson Bay, and west to the Rocky Mountains. Pastoral in local distribution as contrasted with the more urban Brown Bat.

2. *Lasionycteris noctivagans* (Leconte), The Silvery Bat. Four specimens. Common throughout North America. Partial to waterways and known to be a good swimmer.

3. *Adelonycteris fuscus* (Palisot de Beauvois), The Brown Bat. Five specimens. Perhaps the commonest species in the more settled parts of the country. Of wide range.

Fig. 1. Shows a Red Bat hanging by hind feet. Natural size.

4. *Atalapha noveboracensis* (Ecxleben), The Red Bat. Five specimens, three adult and two young. Our most brilliantly coloured species. Habitat, North America at large, excepting the coldest regions.

5. *Atalapha cinerea* (Palisot de Beauvois), The Hoary Bat. Two specimens. Our largest bat. Habitat, Northern regions, occuring southward only at high altitudes. The capture of two specimens at London must be considered highly interesting to the student of zoo-geography.

Of the twenty-eight species treated by Dr. Allen as North American, the five given above seem to be all that have as yet been found in Ontario.

Vesperugo carolinensis (Geoff), The Carolina Bat. Ranging from Massachusetts and Pennsylvania southward, will possibly be found in Ontario.

Upwards of 400 species are known in the world. In the tropics large fruit-eating forms are abundant. Those of temperate regions, as ours, are almost exclusively insectivorous and as such must, generally speaking, be considered beneficial.

Fig. 2. Profile of head of same. Natural size.

Occasionally bats find shelter in badly constructed dwellings. There they congregate each morning in increasing numbers and finally, with much chattering and quarrelling they sink into their long hybernatory sleep.

In some cases the owner of the house, after different attempts to smoke them out with sulphur, is often driven to tearing off boards, and after considerable trouble and expense, gets rid of a colony of one hundred or more.

The most curious zoological fiction connected with bats is the absurd belief that they are the offspring of bed-bugs. Once a wise-acre of our country-side gravely advanced to me this untenable theory of the origin of bats. While admitting that owing to the similarity of their retreats bats might transfer the "bugs" to new quarters, I combatted as best I could the ridiculous statement by showing that it was a wholly unnecessary assumption. But lo! he, as if to demonstrate that "there are more things in heaven and earth than are dreamt of in our philosophy," challenged me to deny that *gorillas* had crossed over from Africa and had taken an effective part with Wellington in the Peninsular campaign against the French. In vain I defined the term "guerilla warfare"—he, forsooth, was a captain of our Canadian volunteers, and not wishing to have exemplified on myself his conception of a "gorilla attack," I escaped the dilemma with the diplomatic rejoinder that one story seemed as true as the other.

The Moles and Shrews.

While we have here to treat of (scientifically speaking) a very different order from the bats, from an economic point of view their similarity is well shown by a quotation from Carl Vogt: "One may, indeed, say with truth that they continue on and under the earth, yes, and even in the water the persistent hunt for insects, snails and all possible vermin, begun by the bats in the air."

The insectivora is a large order of mostly small mammals, forming one of the primitive types of their class. Two families—Talpidæ (moles) and Sorecidæ (shrews)—are well represented in the fauna of Ontario. While externally these animals simulate the appear-

ance of mice, they are in internal structure widely different. The rodent type of teeth as illustrated by the common meadow-mouse, or *vole* (Arvicola riparius), whose sharp, chisel-shaped incisors and flat-topped molars are admirably adapted to the gnawing and grinding of the farmer's grain and roots, is replaced in the moles and shrews by a totally different dentition. Here we have projecting incisors, mostly one pair, canines, pre-molars with pointed crowns and (usually) trifid molars—a machine well fitted for the capture of terrestrial insects, whose hard elytra are crushed with a facility truly surprising.

That the distinction between a *shrew* and a *mouse* is not more clearly known is a decided misfortune to both the farmer and the shrew. Meadow-mice feed on the farmer's crops and are generally treated as they truly are—that is, unmitigated pests. Shrews feed on insects and (in the case of one species, at least) on those very mice the farmer so cordially dislikes. Yet to the average farmer every little furry creature that runs through his fields is merely a mouse, nay even worse than that, if any distinction is made at all, it is usually against the poor little "screw mouse"—an unreasonable prejudice allied to superstition. I have seen a farmer really afraid of a tiny shrew as it darted hither and thither with amazing rapidity in its frantic efforts to escape. To one of such I told, with a touch of irony, a curious superstition held by the Eskimo of Norton Sound, as related by Mr. Nelson in his "Natural History of Alaska."

"Those Indians claim that there is a kind of water-shrew living on the ice at sea which is exactly like the common land shrew in appearance, but which is endowed with demoniac quickness and power to work harm. If one of them is disturbed by a person it darts at the intruder, and burrowing under the skin, works about inside at random and finally enters the heart and kills him. As a consequence of this belief the hunters are in mortal terror if they chance to meet a shrew on the ice at sea, and in one case that I know of a hunter stood immovable on the ice for several hours until a shrew he happened to meet disappeared from sight, whereupon he hurried home, and his friends all agreed that he had had a very narrow escape."

The moles are completely fossorial in their habits, and possess in a high degree the traditional pugnacity of all miners. One meeting by chance a rival above ground, fights with a fierceness that carried on in proportion by large animals would be really terrific.

The earth worm forms the staple food of moles, and as this worm is accounted an important factor in the formation and improvement of soils, the mole must, to that extent, be considered an injury to the agriculturist.

The disfigurement of lawns and gardens by the large quantities of soil thrown up by even a single mole in a night is a serious charge, more applicable, however, to the English mole than to any of ours. The still more serious indictment that our common mole eats the roots of vegetable and other garden plants is likely enough a slander. A mole in a garden burrows along a row of plants in order to procure the numerous grubs and insects which congregate in just such places. Later a *vole* (meadow-mouse), entering the tunnel, finds ready access to its favorite article of diet—the roots of garden vegetables. There is the mole's tunnel—there are the potatoes eaten—and so the mole is condemned.

The Ontario species are three in number.

1. *Condylura cristata* (Linn)—STAR-NOSED MOLE.—A most unique species, owing its

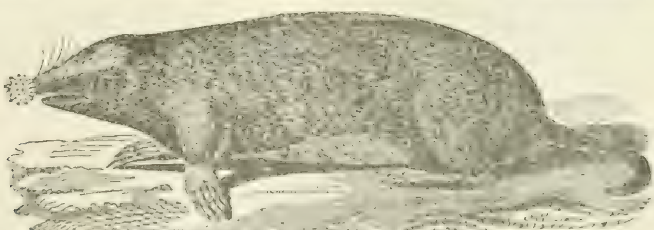

Fig. 3. The Star-nosed Mole (reduced.)

name to about a score of radiating cartilaginous processes on the nose. Partial to moist situations, and so far as my own observations go, our commonest species. Fig. 3 (reduced).

2. *Scalops aquaticus* (Linn).—SHREW MOLE.—The term *aquaticus* as applied to this species is a misnomer, as in its habits it shows a preference for the drier ground, coming frequently into gardens and being of doubtful utility there. Apparently rare in Ontario.

3 *Scapanus Americanus* (Bartram).—HAIRY TAILED MOLE, BREWER'S MOLE.—More northern than either of preceding. In habits resembles the shrew mole. One taken at Ottawa, as reported by Ottawa Field Naturalists' Club, 1890.

The shrews are much more terrestrial than the moles, and are still more mouse-like in their appearance. However, their long, pointed and movable muzzle should serve to distinguish them from mice. Their position in the economy of nature is, as has been pointed out, vastly different. They feed on insects the year round, and are nocturnal in their habits. They are all small, some exceedingly small, the Etruscan shrew, found in Italy, being the smallest of known mammals. Its head and body measure only an inch and a half in length, and its tail adds about an inch more.

What shrews lack in size they atone for in numbers, activity and voracity, and from an economic point of view they must be reckoned among the farmer's best friends. Two genera and several species occur in Ontario.

1.—*Blarina brevicauda* (Say.) SHORT-TAILED SHREW. More mole-like in appearance than any member of the next genus. Besides destroying innumerable injurious insects in the course of a year, this industrious mammal is a persistent enemy to mice, following them into their burrows and killing them there. Common in Ontario.

2.—*Sorex Cooperi*, Bachman.—COOPER'S SHREW. This little dweller of our fields and woods is by no means so rare as its infrequent capture would lead one to suppose. While it moves in its agile, restless manner usually on the surface of the ground, it manages to travel under cover of dead leaves and herbage, thus eluding the notice of all but the keenest observer. Once in the woods about the middle of May, searching for salamanders, under rotten logs, etc., I captured alive a specimen of this diminutive shrew which I had disturbed and driven from his sylvan retreat. Placing it in a large bottle with a handful of cotton batting, I watched it dart through and through the cotton with astonishing rapidity. Ha f an hour later I introduced a live May beetle which was instantly attacked and entirely eaten. Within ten minutes I proffered an earth-worm which was immediately caught at the head and bitten down the middle throughout its whole length. The action although quickly performed left a groove or cut as neatly as any dissector could have done with a knife. The worm at once collapsed and from its whiteness I inferred that its blood had been extracted during the nipping process. As it remained untouched, within another ten minutes, wishing to know whether the shrew's appetite had been satisfied or whether it preferred insects to worms, I dropped in a second May beetle which was at once killed and the major portion eaten, the head and elytra alone remaining. Shortly afterwards the voracious little creature died, overcome as it seemed by the very abundance of supplies —a death suggesting, though somewhat dissimilar from, that of the farmer who, according to the Porter in "Macbeth," "hanged himself on the expectation of plenty."

Fig. 4. SOREX ARANEUS.—A Typical Shrew.

3.—*Sorex platyrhinus* (De Kay) BROAD-NOSED SHREW. In August, 1895, I captured in a field of reaped oats near Plover Mills, an individual of this species which as far as I know remains the only record for Ontario. In habits it differs in no marked degree from its congener, Cooper's Shrew. Fig. 4.—The common European Shrew (*Sorex araneus*)—a typical representative of the large and useful genus, Sorex. Natural size.

THE RACCOON (*Procyon lotor.*)

While the Raccoon is perhaps the most omnivorous of all our mammals, eating with avidity birds and their eggs, frogs, fish, cray-fish, nuts, fruits, corn and sometimes poultry, yet before framing an indictment against him we should give him fair credit for large numbers of insects and mice destroyed in the course of a season.

I have examined the stomachs of many 'coons killed during the time the corn was in the milky stage, and have nearly always found more insects than anything else, notably the red-legged locust, in seasons when that pest was most destructive.

THE SKUNK (*Mephitis mephitica*).

In the face of the unsavoury reputation with which common report invests the Skunk—a reputation partly acquired from an *occasional* raid on the poultry yard to kill chickens or to suck eggs, and partly by reason of his defensive and offensive odour, it is pleasant to quote from Dr. Merriam, the highest authority on North American mammals, the following testimonial as to his sterling qualities : "Of all our native mammals perhaps no one is so universally abused, and has so many unpleasant things said about it, as the innocent subject of the present biography, and yet no other species is half so valuable to the farmer. Pre-eminently an insect-eater, he destroys more beetles, grass-hoppers and the like than all our other mammals put together, and in addition to these devours vast numbers of mice."

In discussing this interesting paper, Mr. Fyles asked whether it were correct that a noticeable difference between a mouse and a shrew was that a cat would not eat a shrew, because it was carnivorous and therefore not suitable for food.

Mr. Saunders said that this was probably not because the shrew is carnivorous, but because it had a peculiar and unpleasant odour, derived from a sack or gland, and that this caused cats, hawks and owls to prefer other mammals. He then exhibited a series of skins of bats, and gave a brief account of each species.

Dr. Bethune, in commenting on the usefulness of skunks, mentioned the benefit they confer upon hop-growers by destroying the larva of a moth, *Gortyna immanis*, which is often very injurious to the plants. This caterpillar eats into the crown of the root and if unmolested gradually burrows through and causes the death of the whole plant. In the hop-yards in the northern part of the State of New York it is related that the owners encourage the presence of skunks and do not allow them to be molested. These animals prowl about the yard and by listening at the foot of a hop-plant discover whether there is a worm gnawing at the root; if so they speedily dig away the earth and extract and devour the worm. It only remains then for the grower to replace the earth and thank his unsavoury friend for the benefit that he has conferred in saving the life of the plant. This injurious insect the speaker had found very abundant some years ago in a large hop-yard at Erindale, near Springfield-on-the-Credit.

Mr. Fyles then exhibited a fine collection of insects recently taken in Barbados, West India Islands, by his son. After the inspection of these and other specimens that were brought by the members present, the meeting adjourned.

EVENING SESSION.

In the evening the Society held a public meeting in its rooms in Victoria Hall, at which there was a largely increased attendance of members, between thirty and forty being present. The chair was taken by the President, Mr. Dearness, at 8 o'clock. After explaining the much regretted absence of Dr. Fletcher, who was unavoidably prevented from attending, he proceeded to deliver the annual address, which he illustrated with specimens and drawings on the blackboard, and also with photographs, and which was listened to with great interest and attention.

ANNUAL ADDRESS OF THE PRESIDENT.

By J. Dearness, London.

Friends and Members of the Entomological Society of Ontario :

I have the honor this evening to welcome you to the thirty-fourth annual meeting of the Society. By name, at least, I know of five other similar Societies on this continent : the American, the Cambridge, the Newark, the New York, and the Washington. The organization of only one of these, the first named, antedates that of our own Society.

The thirty-fourth annual meeting! To the younger members, who, but for a year or two have been witnesses of the work done in these rooms, and who have been reading the reports and the monthly issues of the *Canadian Entomologist*, it may be worth while to say that there is evidence that each and every one of these thirty-four years has been characterized by energy, progress and success, one almost equally with every other from the first until now.

The evidence is not far to seek, in fact we are overwhelmed with it. These shelves, stocked with reports and volumes, filling two sides of the room, tiers of drawers and cases of specimens, classified and catalogued, crowd us so that we scarcely have room for our chairs. Very material evidence this, even on the surface, that busy men founded this society and labored to promote its interests. In doing this great work two objects or purposes conspicuously inspired them—devotion to science for its own sake, and the desire to discover and disseminate knowledge for the sake of their fellow-men. No other incentive seems to have had any existence in their minds.

On the eve of removing from these rooms, where so much of the society's work has been done, to more commodious and convenient quarters, it seems opportune to turn our thoughts to the labors of the Society's veterans. We younger members cannot over-appreciate the rich heritage left us by these pioneers, and we should be stimulated by the contemplation of it to prepare ourselves to carry on the work in the spirit and enterprise of the example they have set us. The events of the year give emphasis to this statement. I presume only one person here can recollect attending an annual meeting before this one from which our beloved friend, the late Mr. Denton, was absent. His kindly voice, and that of another officer of this society, Capt. Gamble Geddes, of Toronto, have lately been hushed in death. The thought of their passing and leaving the work here which they had so much at heart suggests the desirability of the Society's compiling a memorial album, with portraits and sketch of its founders and its most earnest and useful workers.

A moment ago I said, "only one person here." I need not name him, as you all know it must mean the venerable editor of the *Entomologist*, Dr. Bethune, of Port Hope. Was he not at the inception of the society thirty-four years ago (in fact he and Dr. William Saunders, now director of the Dominion Experiment Stations, were its parents in every sense), and has he not attended nearly every annual meeting since its inception? May that one be many a year distant when he shall cease to be present ; I can hardly conceive what one would be like without him and Dr. Fletcher and the Rev. Mr. Fyles. And although they all seem good for many years to come, yet you younger members must prepare to take their places sometime. I trust that even now you are observing, studying, reading—equipping to sustain and extend the good work so successfully begun.

Much has been accomplished, a very considerable library has been founded, much valuable material has been accumulated, a fairly complete taxonomy of the important insects of Canada and the neighboring States, has been placed on exhibition, and thus a foundation has been well laid that will enable future workers to specialize and to engage in practical studies with definite purpose.

Some Injurious Insects.

It has been usual for the President, in his annual address, to present an economic entomological survey of the province. My field of observation has been limited to the six or seven townships around London.

Last year our Curator, Mr. Moffatt, reported the prevalence of the cut-worm moth, *Hadena Arctica* (Fig. 5) Householders in town and country remember the nightly dance of these moths around the lamps and their soiling of curtains and clothes during the day. This spring I noticed many a patch of spring grain that had been sown on plowed sod so badly eaten that the ground was plowed again and sown with peas or otherwise used. The farmers said the wire-worms are at work, but in any plot I examined it was no trouble to discover the greenish-yellow cut worm, the larvæ of the *Hadena*. Would rolling the affected part of the field at night with a heavy roller across the drills destroy enough of these larvæ to save the crop? I should like to hear the point discussed whether we may expect another invasion of our homes by this moth next year, such as Mr. Moffat described in the last report. I did not find any specimens that seemed to be parasitized.

The grasshopper or locust (*Melanoplus femur-rubrum*, De Geer, Fig. 6) was not nearly so injurious as in 1895. Its partial disappearance is probably mainly due to the increase of its parasite, the red mite, *Astoma* (Fig. 7).* The spring was favorable for the development of the grasshopper, and in some localities it was present in prodigious

Fig. 5.

Fig. 6.

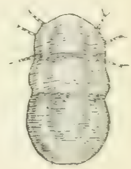

Fig. 7.

numbers. I never saw them more numerous or vigorous than on the 18th of June along a side road between Con. vii. and viii. of McGillivray. Two or three miles on either side of this locality but few were to be seen. Where they were numerous I did not find one parasitized specimen; where they were scarce but few had not the red mites adhering to them under the wings.

In a few limited areas of the country the army-worm, *Leucania unipuncta*, appeared in countless numbers and destroyed or greatly damaged oats, barley and corn. In early September the imagines were abundant everywhere in the range I travel. With the moths so numerous and generally distributed one would naturally expect the insect to be destructive next year. If such expectation is fortunately not realized, the interesting question arises—what influences have checked it? Is the multiplication of the Tachina fly so rapid as to prevent its appearance in destructive numbers the second year in the same district?

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* Dr. James Fletcher, of Ottawa, writes that the prevailing opinion of arachnologists is that the *Astoma* (or *Atoma*) is the larval form of *Trombidium*, and that in Henshaw's Bibliography of Economic Entomology *Astoma gryllarium* is given as synonymous with *Trombidium locustarum*. Further references are Andrew Murray's "Aptera," pp. 128-129; Riley's "Rocky Mountain Locust," pp. 128-130; Lintner's Eighth Report, 1891, page 180; First Annual Report United States Entomological Commission, pp. 306-311. As a rule the six-legged mites are the larval forms.

The Fall web-worm, *Hyphantria textor*, has been very common in this county. I know two localities where every black ash—of which there was a considerable number of trees—was completely defoliated. Not a vestige of leaf was left. The trees were literally enwebbed from the top to the root. Seizing the webby fabric on the trunk it could be pulled off in strips reaching to the lower branches.

Fig. 8. *a*, worm; *b*, chrysalis; *c*, moth.

The orchard fruits in this country have been unusually free from insect injury. In 1895 fruit was a failure, owing to the heavy frost late in May. Its scarcity caused every apple that escaped to be gathered carefully. None was allowed to remain on the ground. This year all wormy fruit, and indeed much that is not wormy, is left to rot, so abundant is the crop and so insignificant the price for it. Hence the insects will develop without let or hindrance, save from their natural enemies. The abundance of this year's crop points to increased need for spraying next year.

Failure of Pea Crop.

It would be out of place here to speak of fungal and bacterial injuries to crops, etc., to which I give more attention than to insects, but I may refer to the failure of the pea crop in Prince Edward County. Some farmers there find it profitable to raise garden pease for sale to the seedsmen. This year the crop failed; the diseased plants looked as though they were affected by a parasitic fungus. Mr. Craig, the Dominion Horticulturist, kindly sent me a large number of specimens. On many of them I found fungi, all probably saprophytic, not disease producing, but produced in the diseased or dying tissue, and, what is more noteworthy, on many, in fact nearly all the roots I examined, a minute Nematode or Anguillula-like worm. There were not any nodules such as the rose anguillula produces on the roots of that plant in the green-house. Much damage is done to plants in the Southern States by anguillulæ, but it has been thought that the winters in our latitude are too severe for any organism of this class to survive in injurious numbers. The failure of the pea crop in that county needs further investigation. I believe it was due to several causes, one of which was the presence of these nematodes.

Parasitic Fungi.

Speaking of fungi naturally leads one to think of the work done in a new and important field, that of artificially controlling injurious insects by vegetable parasitism. Colonies of silk-worm and of the honey bee are occasionally devastated by a muscardine and pebrine and foul-brood respectively, which are fungal and bacterial parasites. It is not unreasonable to suppose that similar parasites may be discovered capable of artificial cultivation which may be introduced among gregarious insects as grasshoppers, army-worm, etc., and used to control them effectively. Prof. Forbes, of Illinois, has experimented extensively upon inoculations of the Chinch bug.

Laboratory experiments have been conducted in Cornell Agricultural Experiment Station by Mr. R. H. Pettit, under the direction of Professor Atkinson, with various parasitic fungi upon several different kinds of insects. Dr. Roland Thaxter has done plendid work on the *Entomophthoreæ*. Prof. Snow, of Kansas, Prof. Webster, of Ohio, and others, have also labored in the same field. So far, while many of the laboratory experiments have been successful and promising, the work in the field has not yet, to my knowledge, reached very satisfactory results.*

* Since writing the above I am informed by Dr. Bethune that at the Buffalo meeting of the Economic Entomologists, August, 1896, Prof. Webster, of Wooster, Ohio, stated that farmers in the districts of that State badly infested with the chinch-bug had eagerly obtained and used specimens of the pest artificially inoculated with *Sporotrichum* to distribute where chinch-bugs would come in contact with them, and thereby contract and spread the disease. He reported satisfactory and encouraging results.

The subject of entomogenous fungi is too large to enter on here, but it may be of interest to show specimens of a few of those most commonly met with.

The first is a parasite on the scale insect (*Lecanium* sp.), which I find on oak, ash, and blue beech. It is called *Cordyceps clavulata* (Schw) ; the genus is in the same order with the medicinal ergot or smut of rye. The fungus feeds upon the tissue of the insect, displacing the latter by its vegetative portion. It matures by producing erect sporophores, $\frac{1}{8}$ to $\frac{1}{4}$ inch long, bearing papillate conical heads. Under each papilla is embedded a perithecium containing numerous sacs or pods called asci, each of these sacs contains eight long, separate sporidia or "seeds."

Fig. 9. Fig. 10. Fig. 11. Fig. 12. Fig. 13.

Fig. 9.—Twig with two scale insects. One of them killed by *Cordyceps clavulata*, having three sporophores of the fungus.

Fig. 10.—Head of one of the sporophores enlarged.

Fig. 11.—Cross-section of head of sporophore showing the flask-like perithecia greatly enlarged. These perithecia are filled with sacs as indicated at *a*.

Fig. 12.—A sac or ascus containing eight sporidia still more highly enlarged.

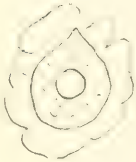
Fig. 13.—A sporidium or "seed" magnified 750 diameters.

The fly-fungus, *Empusa muscæ*, Cohn, belongs to a very different group of fungi. The former is placed in the class with black-knot of the plum tree and the mould on the gooseberry. This has close relationship to the white mildew of the grape, to the peronospora which produces soft rot of the potato, and to that causing a peculiar stinking decomposition of fish. No doubt you have observed dead flies surrounded by a whitish halo adhering to a pane of glass. This halo consists of the spores, conidia—and secondary spores thrown off by the growing fungus from the body of the infected fly.

When one of these living spores gets attached to the under side of a fly's abdomen, it puts out a tube which penetrates the skin and rapidly spreads through the whole body in the manner in which yeast grows through bread, feeding upon the fatty substances within the fly. The exhausted fly finally settles, it may be on a pane of glass, there the fungus by abjunction scatters its spores around the body producing that smoky halo to which I referred.

Dr. Roland Thaxter in his masterly monograph on the Entomophthoreæ in which he describes the various known species which affect flies, mosquitoes, gnats, aphides, cicadæ, thrips and lepidopteræ, says of the house-fly fungus that its occurrence out of doors is an exceptional phenomenon, and that he knew of only two instances. His observation makes the specimens I have laid on the table the more interesting, as they were collected

off leaves and twigs near the edge of Cranberry Lake, in the County of Oxford. (A box containing twenty or thirty olive-colored flies killed by this fungus was passed round for examination.)



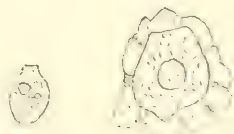


Fig. 14. Fig 15. Fig 17. Fig 18.

Figs. 14 and 16.—Conidiophores forming white rings between the segments of the abdomen. Highly enlarged.

Figs. 15 and 17.—Primary and secondary conidia which form the smoky halo seen round the fly adhering to the pane of glass. Highly enlarged.

Fig. 18.—Conidiophores of *Isaria farinosa* slightly enlarged.

Another fungus, or stage of a fungus, doubtless quite common though not frequently observed, bears the name *Isaria.* These specimens which I have here grew upon pupæ, probably of Arctiids, and are labeled *Isaria farinosa*, Fr. They are supposed to be a stage of *Cordyceps.* Out of the insect grew these conspicuous sporophores, ¼ to ½ inch long, orange at base but covered when fresh for two-thirds of their upper part by a white dusty layer of spores which arise from the ends of the threads forming the sporophore. At Cornell, spores from a potato culture of this fungus were painted on the ventral side of seven "woolly-bear" caterpillars; in twenty days the fungus had attacked all but two of them, and in another month one of them had developed showy sporophores like that from which the culture had been taken.

Fig. 19. Fig. 20.

Fig. 19.—A thread of *Sporotrichum globuliferum* bearing spores greatly enlarged.

Fig. 20.—A thread of Isaria bearing spores separated from the compact sporophore. Greatly enlarged.

The fungus which has been used for infection experiments with the chinch-bug is known as *Sporotrichum globuliferum.* It was first found on Carabidæ and is somewhat like Isaria in its method of growth. Instead of the filaments being compacted into sporophores they envelop their hosts in a loose white cottony swathing. (An example of sporotrichum on a beetle was exhibited, also larvæ bearing *Isaria*).

Entomological Literature.

The President's addresses have usually presented a brief review of the entomological literature of the year. That duty will be discharged this time by Dr. Bethune. I have just a word in reference to two publications that have recently come to these rooms—one, a report of the Gypsy Moth Commission prepared by Drs. Forbush and Fernald,—a volume of over 600 interesting pages, devoted to one injurious insect. I refer to this to show what labor may be involved in studying and combatting even one insect. The labors of the Massachusetts entomologists in controlling the spread of the gypsy moth are a monument to the value of economic entomology.

The other publication to which I refer is a bulletin called "Practical Entomology" by Messrs. Hopkins and Rumsey of the West Virginia Agricultural Experiment Station. It is a veritable *multum in parvo* and although it contains only about 80 pages it keys and classifies the insects injurious to farm and garden crops in a very unique manner. The most inexpert farmer or gardener is led directly to a pretty certain identification of his insect foes and the approved remedies are briefly indicated. I wrote a letter to the authors complimenting them upon their plan of presenting practical entomology to the agriculturist. Director Myers acknowledged the letter and stated that it is their intention to continue this line of practical instruction to the horticultural and other interests and probably finally to publish the work in book form.

Teaching Natural History in Schools.

On every occasion that has offered the opportunity, I have put in a plea for such modification of our school curriculum of studies as would provide for the education of the observing faculties of our children. Training to observe facts, and to relate causes and effects not only affords good mental discipline but is of the highest practical value. We must all to a greater or less extent be experimenters throughout our active lives; hence skill in observing, comparing, relating and judging is necessary to success. Properly conducted nature-study is therefore of very great value. For the purposes of such study local geography, and the phenomena of weather, plant and insect life, furnish the very best material.

The flower and the insect appeal powerfully to the child's interest and while in botany and entomology there are many problems that the greatest observers and thinkers have not answered, yet there are others that even the little kindergartners find a pleasure in solving when the proper method is pursued. At teachers' meetings and at the Central Farmers' Institute I have outlined a course of study pointing out what might be attempted, especially for the benefit of farmers' children in entomology, etc., in each grade. A few years ago Prof. Wm. Saunders read papers here entitled "Entomology for Beginners." He treated in a popular way the life history of the cabbage butterfly, the leopard moth, the polyphemus, the satellite sphinx, the red humped apple-tree caterpillar and the eyed elater.

We need such papers as those—modified so as to treat in an experimental manner the life history of a half-dozen common typical insects—containing practical suggestions on observing their habits, capturing, caging, feeding, and preserving them. The paper might be issued by this Society as a bulletin. The teacher would find additional assistance in such works as Prof. Panton's "*Insect Foes*" and Packard's *Entomology for Beginners*. Besides the educational value and pleasure to the children of such study consider what important practical bearing it would have. Such mistakes as I knew a gardener to make would not then occur. He killed the tomato sphinx larvæ by stamping on them, but those bearing the coccoons of its parasitic ichneumon he carried to the house to be immersed in boiling water to kill the eggs as he thought. Think of it, ignorantly scalding his best helpers!

Last spring I went to the proper committee of the Western Fair Board with the request that it offer prizes or diplomas to schools for exhibits of the life history of injurious insects. Our thanks are due to the committee for compliance with the request as it has shown what can be done by a teacher and his pupils in this line when he seriously addresses himself to the task. I have the exhibits here from school No. 14, N. Dorchester, and Union 5 and 15 London. The teacher in No. 14, Mr. J. W. Atkinson, had no technical knowledge of insects when he set about this work but taking advantage of the presence of the army worm in his section and following a few written suggestions on technique, he caged the larvæ, reared the moths, secured the eggs, and captured several beetles which prey upon the larvæ. What an object lesson this was to the children? How much more interesting, useful and exact their knowledge of metamorphosis having thus observed it, than if they had merely read the account of it in a book, even in a pretty picture-book. I think the result of this effort is well worth publishing. To that end I have had this photograph of the exhibit taken. See opposite page 32. It does not and cannot show the written sketch and the specimens of barley, oats, corn and mangolds damaged by the larvæ, but it will afford suggestions and stimulation to teachers who may see this report.

The exhibit of the squash-bug showing this injurious insect in seven stages from egg to adult males and female with a biographical sketch and specimens of its work on the pumpkin was prepared under the guidance of one of our young members, Mr. Robert Elliott of Plover Mills, in Un. 5 and 15. (The exhibits, written accounts and mounted specimens of the damaged crops, corn, oats, etc., were passed round.)

The report of the Council outlines the work of the Society for the year. The general verdict on its persual will be "Well done.". The only opinion meant to be adverse which I have ever yet heard upon the work of this Society is that too much attention has been paid to American insects and that our pages have shown too much intercourse with the entomologists of the United States. Congress gives to every State in the Union $15,000 annually to devote to experiment station work. To each of these stations are attached one or more practical entomologists. What a large staff of trained workers this liberal policy must tend to produce. Are we to be blind or indifferent to the wealth of investigation and result these men are accomplishing? The potato beetle, the horn fly, the army worm, have to be combatted—in short which of our injurious insects has not to be combatted by the farmers of the northern United States as energetically as by ourselves, indeed it is usually from and through that country they reach us for unfortunately these insects pay no attention to political boundaries nor customs' officers I believe the Americans as well as the vast majority of our own people realize that entomologically theirs and ours is one country. The Americans have honored two of our members—Dr. Fletcher and Dr. Bethune by electing them in 1889 and 1893 respectively as president of the entomological section of their chief national science association, President Cook at the Indianapolis meeting in 1890, speaking of "our country" said, "by ours I include, of course, our Canadian brothers for we, as scientists know no line of separation." That sentiment is reciprocated here.

American entomologists cordially work with ours for the common good. I remember Prof. Saunders relating that Prof. Lintner, State Entomologist, Albany, N. Y., had enlisted his co-operation to control the gooseberry saw-fly, *Nematus ventricosus*, by sending him parasitized eggs of that species. This is but an instance that might be multiplied. At a meeting in Brooklyn, N. Y., Mr. L. O. Howard, Chief Entomologist at Washington, after highly complimenting the Rev. Dr. Bethune as a Canadian entomologist testified that—in a large measure due to Dr. Fletcher and to Dr Saunders—economic entomology had been energetically prosecuted in Canada. "Canada" he says "has the man (Dr. Fletcher) and the knowledge but has been hampered by want of funds. The result is that while she has immediately and intelligently adopted the results of researches made in this country she has not been able to lead us in original investigation."

It is foolish to think of entomological areas being demarked by parallels of latitude or even by rivers and lakes. President Saunders in his address in 1882, declared that although belonging to Ontario and sustained in our work mainly by the liberal aid granted us by the Ontario Government, our sphere of usefulness extends throughout the length and breadth of this great Dominion, and also across the lines into the United States. That declaration is true; we can and do help our cousins across the lines and we are helped in return. The close student of the intercourse knows that we get as much or more than we give.

May our entomologists ever keep a watchful eye on the methods and results of their American confreres and continue to be regarded by them as skilful and helpful co-workers, and worthy in the future as in the past to fill places of honor in their national conventions.

Discussion on the Address.

In rising to move a vote of thanks to the President for his very able and interesting address, Dr. Bethune said that he had been very kind in referring in so complimentary a manner to the founders of the society. Many years ago, Dr. William Saunders and the speaker set to work to gather together all those in this Province who were interested in entomology. After a meeting had been called, much assistance was given by Messrs. Croft and Hincks, two professors in the University of Toronto, and Dr. Sangster, who was at the head of the Normal School. Thus a beginning was made, and each year was marked by the addition of more members, and by some good work done. One of the early members was our lamented friend, Mr. John Denton, who had passed away since our last annual meeting, and who was esteemed and respected by every one who knew him. We all missed his kindly presence and the genial hospitality with which he always welcomed the members from a distance. He took the deepest interest in the welfare of the society, and by his exertions and wise counsels did much for its permanent success. The speaker also referred to the loss the society had sustained by the death of Captain Gamble Geddes, who had been an active member for many years and one of the Council representing Toronto Division.

Dr Bethune then spoke of the great value of the President's researches into the life history of parasitic fungi and the practical advantages that may result from them, and referred to the excellent work that was being done in this respect by scientific men in the United States. He had learnt, with much surprise, that objections had been made to the annual reports of the society on the ground that so much attention and space was given to the proceedings of the American Association of Economic Entomologists. In the first place it should be remembered that this association was originated by Dr. Fletcher, of Ottawa, and was organized and held its first meeting in Toronto; it is therefore as much a Canadian as an American society. Furthermore we must all feel that science has no political, geographical, religious or sectional boundaries; it embraces the whole world, and on this continent we know that, while we can sometimes help our American cousins, we are largely indebted to them every year for valuable additions to our knowledge. We who study entomology are especially aware of this. Many noxious insects have come to us across the frontier, paying no respect to political boundaries or custom-house officers, and we have been prepared for their coming and taught how to receive them on their arrival by the experience and the labours of our friends "on the other side." But for this knowledge we should be in an unhappy plight, and while we were trying experiments and studying out the history of the insect, it would be sweeping unchecked over our fields or fruit trees. Surely it is most important that we should take the earliest opportunity possible of giving to our farmers and fruit-growers the experience that has been gained by the various state entomologists and experimental stations scattered over the continent, and afford them information which they would be unlikely otherwise to obtain.

Mr. Fyles, in seconding the vote of thanks, expressed the great delight with which he had listened to the President's address, especially to the part relating to fungi, which

opened a wide field of great interest, and he felt personally very grateful to the President for giving such a clear account of the growth of fungi and bringing before the meeting matters with which few of them were familiar.

After the vote of thanks had been put to the meeting and pronounced "carried," amid much applause, the President introduced Professor Panton, of the Ontario Agricultural College at Guelph, whose work and labours were, he said, well known to all who are interested in agriculture and entomology. Prof Panton, who was very warmly received, said he had great pleasure in being present at this annual meeting of the Entomological Society of Ontario. He had done a good deal himself to disseminate the teachings of the society during the last fifteen years, and each year he had been much interested in reading the reports of its proceedings and researches, but till now he had always been prevented from being present at its meetings. He then proceeded to give the following address:

ENTOMOLOGY FOR RURAL SCHOOLS.

By Professor J. Hoyes Panton.

It is a gratifying thing to observe, that within the past few years, there has been a growing desire, on the part of farmers, to know more of the teachings of science, as it bears upon agriculture. It has been the privilege of the writer to attend many Farmers' Institutes since their commencement. At first, any topic of a scientific nature excited but little interest. The great majority cared little to hear about a subject, which seemed entirely of a theoretical nature; and, far removed from the truly practical work of the farm. However, that condition has passed away, and the average farmer now feels, that a knowledge of the teachings of science lies at the very foundation of success in the pursuit of agriculture.

He has learned that science is simply systematized knowledge; that its principles are founded upon the facts which are discovered daily on the farm, or in the orchard. In reality, the farmer is one of the most scientific of men, and is surrounded by conditions especially fitted to develop observation, comparison, and method in work. The Farmers' Institutes have done a great work in awakening farmers to the necessity of a study of science, as it relates to their work. But we believe, a greater future is in store for the people of rural districts, when their children shall have become acquainted with the teachings of science, by giving some attention to its study, while, at the common school, in their neighbourhood. With a view to direct attention to how the study of economic entomology might be taught in country schools, this address is given before the Entomological Society of Ontario. The subject of entomology is one well fitted for study in rural schools; specimens are readily obtained for illustration, and, it is especially suited to interest young minds.

This can be accomplished without additional expense in purchasing books, and with little withdrawal of time from the time-table.

The writer would suggest a series of talks upon the subject the last hour on Friday afternoon, during a portion of the summer months, when insects are most numerous.

Especial attention should be directed to such insects as are beneficial, or injurious, invariably having the pupils collect specimens and contribute them so as to form a collection that would represent the economic entomology of the section.

The following might be taken as an outline of several talks, before specific forms of insects were discussed, and with a little study on the part of any teacher, would supply valuable information:

I. *Definition of an Insect—Nature of the Mouth—Life History.*

An insect, Fig. 21, may be described as having three well-marked divisions: head, thorax, and abdomen; one pair of antennæ (feelers), three pairs of legs, usually two

pairs of wings; respiration by means of tube-like structures (*tracheæ*), simple and compound eyes and jointed limbs. Most insects undergo metamorphosis—that is, pass through a series of well-marked changes in their development from the egg to the adult condition.

Among insects we find two typical mouths: the masticatory or biting, characteristic of beetles and the larvæ of many insects; and the suctorial or sucking, represented in butterflies and plant-lice. A knowledge of these facts becomes of importance in the application of insecticides. Insects with *masticatory* mouths can be readily poisoned by applying some poison, such as Paris green, to their food; but those possessing a *suctorial* mouth must be treated with a substance that kills by contact and not by being introduced into the digestive system. Such insecticides as *Kerosene Emulsion* and *Pyrethrum* powder are suitable for this mode of treatment. Thus, by knowing the nature of mouths, we are able to suggest what substance is likely to be effective in destroying insects.

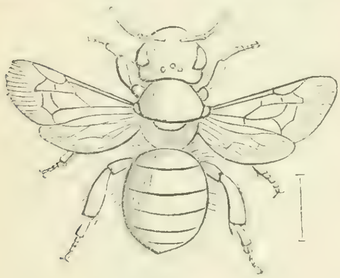


Fig. 21.

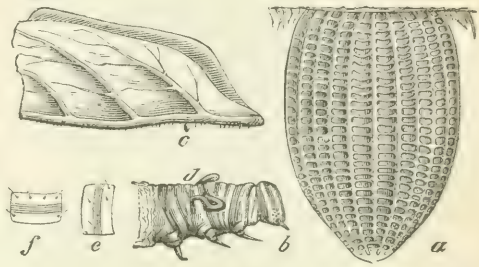


Fig. 22.

The development of an insect is represented by four stages—*egg*, *larva*, *pupa*, *imago*

The following figures illustrate the different stages of the Archippus butterfly, a red and black species which is familiar to every one. Fig. 22, *a* represents an egg, highly magnified, and *c* the egg of the natural size on the underside of a milkweed leaf; *b* shews the head and anterior segments of the caterpillar before its last moult, at *d* are the long fleshy horns, which at this stage are tucked under the skin; *e* and *f* shew the arrangement of the bristles on the segments.

Fig. 23.

Fig. 23 represents the caterpillar which is handsomely marked with black, yellow and white transverse stripes.

Fig. 24.

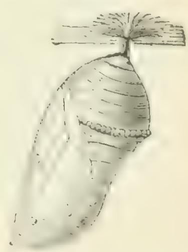


Fig. 25.

Fig. 24. shews the caterpillar at *a* suspended from a little button of silk preparatory to changing into a chrysalis; at *b* and *c* it is making further developments, till it becomes a lovely green pupa decorated with a band of golden spots, Fig. 25.

From this emerges in course of time the splendid butterfly, Fig. 26, which soars so gracefully through the summer air.

Fig. 26.

The *larva* (*larva*, a mask) is frequently without external organs and has a biting mouth; hence, it is a great feeder and usually very destructive to vegetation. The larval condition continues from two to six weeks in most; but there are some in which it is more than a year, *e.g.*, the wire worm, white grub, and some "borers."

Pupa (*pupa*, a doll). This is generally a resting condition, which, in summer, usually lasts but a short time (about two weeks); but if entered in autumn, continues till the next spring. The term *chrysalis* (*chrysos*, gold) is often applied to this stage in butterflies, because in some it is dotted with golden spots. In most moths a *cocoon* is woven around the pupa. Nymph is applied to the young of such as do not undergo complete metamorphosis in development; in such the young are much the same in appearance as the adult, but smaller, and usually wingless; *e.g.*, grasshoppers, bugs, etc.

Imago (*imago*, an image). This term is applied to the perfect insect, which is often harmless, as far as feeding upon vegetation is concerned.

The following names show some of the common terms applied to these stages in some orders of insects:

Larva	Pupa	Imago.
Borer, grub	"	Beetle.
Maggot	"	Fly.
Caterpillar or worm	Cocoon	Moth.
" "	Chrysalis	Butterfly.
Nymph	Nymph	Grasshopper.

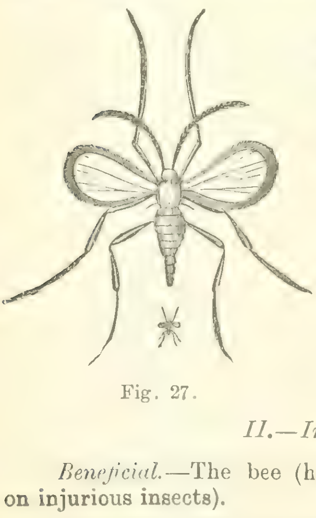


Fig. 27.

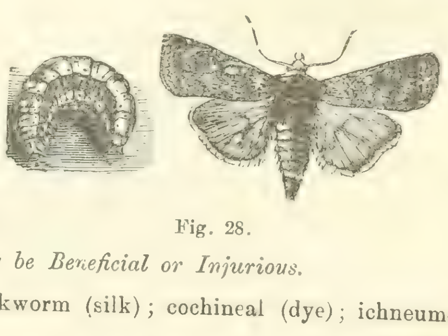


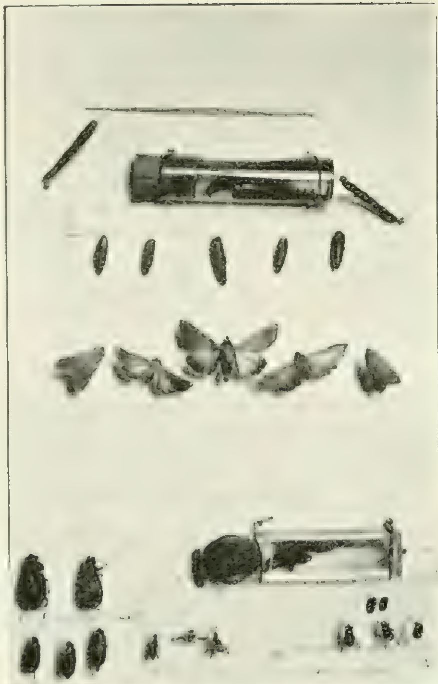
Fig. 28.

II.—Insects may be Beneficial or Injurious.

Beneficial.—The bee (honey); silkworm (silk); cochineal (dye); ichneumon (feeds on injurious insects).

Injurious.—Those affecting the products of the field (midges, Fig. 27, the wheat midge, etc.); the garden (cut-worms, Fig. 28, etc.); the orchard (borers, Fig. 29, etc.)

SCHOOL EXHIBIT OF THE LIFE-HISTORY OF THE ARMY WORM (see page 28).



A case illustrating the Life History of the Army Worm.

A case illustrating the Life History of the Tussock Moth.

III.—Remedies.

1. *Natural enemies.* *a. Birds.* Many investigations have been carried on to learn what insectivorous birds are useful in assisting man to keep in check his insect foes.

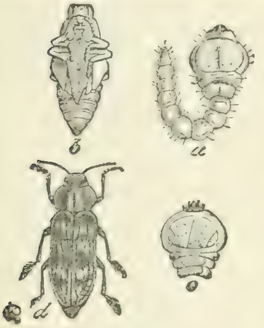


Fig. 29.

Thousands of birds have been shot, and the contents of their stomachs examined so as to ascertain with accuracy if the insects eaten were injurious. In some cases as many beneficial insects were devoured as harmful. The result of careful examination into the subject has been to consider the birds named in the following list as benefactors to the farmer, the fruit grower, and the gardener, and should, as far as possible, be protected and permitted to increase in number :—

King bird, pewee, night-hawk, swallow, whip poor-will, American redstart, yellow-billed cuckoo, blue bird, white-bellied nuthatch, red-headed woodpecker, high-holder, hairy woodpecker, downy woodpecker, golden warbler, red-eyed greenlet, yellow-throated greenlet, Wilson's thrush, brown thrush, cat bird, red-winged blackbird, crow blackbird, oriole, meadow lark, indigo bird, song sparrow, grass finch, chipping sparrow, chewink, purple finch, snow-bird, American goldfinch, horned lark, wren, chickadee, golden-crowned kinglet ruby-crowned kinglet, and American creeper.

(*b*) *Mammals.* Moles, bats, shrews, racoons and skunks. (See Mr. Elliott's paper on Insectivorous Mammals.)

(*c*) *Insects.* Among the most beneficial insects we find the following in the different orders :

Fig. 30.

Fig. 31.

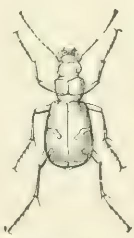


Fig. 32.

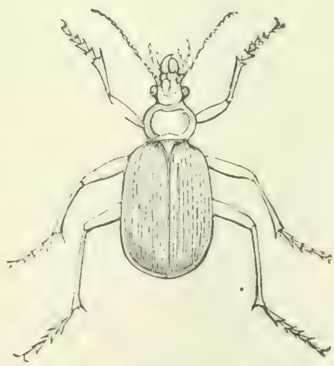


Fig. 33.

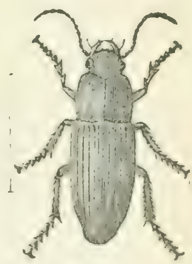


Fig. 34.

Order Diptera.—Syrphus fly (Figs. 30 and 31); Tachina fly.

O. Coleoptera.—Cicindela (tiger beetles) (Fig. 32); Calosoma (Fig. 33); Harpalus (Fig. 34) (ground beetles); Coccinella (lady-birds) (Figs. 35 and 36).

Fig. 35.

Fig. 36.

Fig. 37.

Fig. 38.

O. Hemiptera—Reduvius, Arma (soldier bugs) (Fig. 37).

O. Neuroptera.—Chrysopa (laced-winged flies) (Fig. 38).

O. Hymenoptera.—Vespa (wasps) (Fig. 39); Chrysis (cuckoo flies), Ichneumons, (Fig. 40).

Fig. 39.

Fig. 40.

The above insects are of great importance in keeping the injurious insects upon which they prey in check. The ichneumons are most valuable in this respect. They are very numerous, and prey on many injurious insects, by depositing eggs in the larval forms. These eggs give rise to larval ichneumons that feed upon their host, which finally dies. About this time the ichneumons are developed and escape as perfect insects. The lady-birds are destroyers of plant lice; ground beetles prey on the potato beetle and several caterpillars, and the tiger beetles are great devourers of several species of insects.

(*d*) *Plants.* Some plants in the lowest orders do good service in destroying insects by being parasitic. Some (Empusa) attack the flies in autumn; some (Sporotrichum) the dreaded chinch bug, which is sometimes a serious pest in various parts of the United States; while the white grub has among its destroyers the parasitic fungus Cordyceps.

2. *Insecticides (substances used for killing insects), Gas, Paris Green and Kerosene Emulsion.*

Poisonous gas, generated in tents placed over shrubs and trees affected by scale insects, etc.

Carbon Bisulphide.—This colourless liquid is a most effectual remedy to get rid of insects in granaries, but great care requires to be taken as it is very inflammable and explosive, and may lead to serious results if any fire is brought near; even a cigar or pipe used where the vapor is being evolved may prove disastrous. It readily volatilizes; the vapor is heavier than air and is deadly to insect life. In using it the liquid may be placed in a small shallow vessel and put on the top of the grain, in bins or barrels. These are covered so as to keep in the vapor, which sinks down through the grain, destroying insect life wherever it comes in contact with it. After the operation is over the grain will lose all odor in a short time if exposed to the air. Some prefer taking a wad of cotton or tow, saturating it with the liquid, then plunging it into the middle of the bin and leaving it. Two or three bunches thus placed among the grain will soon kill all such pests as are found in it. One ounce is about sufficient for two bushels of grain.

Paris Green.—(Arsenite of copper, containing 50 60 per cent. of arsenic.) This is applied dry or in solution. In the dry form it should be mixed with 50 to 100 parts of plaster, wood ashes, flour or air-slacked lime and dusted upon the affected plants. The form in solution is usually one pound of Paris green to 200 gallons of water; but if the foilage is tender, 250 to 300 gallons of water may be used. This is the usual strength applied upon the plum and peach. As the green powder does not dissolve it requires to be kept thoroughly mixed by constant stirring. One pound of lime to every 100 gallons will prevent injury to the foliage. The Paris green should be first made into a thin paste, in a small quantity of water, and then added to the full amount of water.

Kerosene Emulsion.—This is a mixture of coal oil and water.

Riley-Hubbard Emulsion.—Consists of half-a-pound of hard soap in one gallon of water. Boil till dissolved, and then add two gallons of coal oil, and mix thoroughly for about five minutes. When properly mixed it will adhere to glass without oiliness. This can be done by forcing it through the nozzle of a force-pump repeatedly until the mixture appears complete. It will then form a creamy mass which thickens into a jelly-like substance on cooling. In using dilute with nine parts of soft water. This form is very commonly used and is easily prepared. If the foliage is very tender the emulsion must be more dilute, fifteen to twenty parts water.

Whale oil soap is better than the common hard soap, especially if the emulsion is to be kept for some time. Soft soap may be used instead of hard, using one quart. Where the water is very *hard* sour milk may be taken; in that case you require only to mix the coal oil (two gallons) and milk (one gallon) to get the emulsion, the soap not being required. This emulsion is liable to spoil if kept long. Kerosene emulsion is a most successful remedy for plant lice and scale insects.

3. *Barriers.*

Using barriers to check the progress of injurious forms, such as chinch bug, army worm, etc.

4. *Traps, Baits.*

Entrapping the insects, such as codling moth, canker worm and cut worms.

(a) Trap the larvæ crawling up and down the trunk by bands of rough cloth or tow, under which they will crawl and spin their cocoons.

(b) Use means to trap the climbing females. This may be done by putting a band of some material smeared with tar around the tree, or using what are known as "tree protectors," a sort of funnel-shaped structure that is fastened around the tree three or four feet from the ground; these prevent the females from getting up the tree.

(c) In gardens poisoned baits may be successfully used, such as small bunches of clover, cabbage leaves, etc., dipped in Paris green solution (one pound Paris green to one hundred gallons water), and placed near the attacked plants. The cut worms will feed upon these and be destroyed.

5. *Agricultural.*

1. A proper rotation, so as to avoid sowing crops in fields where they are likely to be destroyed by insects.

2. Using good seed, *e.g.*, peas without bugs.

3. Varying the seeding time so as to have the plants either too late or too early to be attacked by injurious insects.

4. Summer fallowing, so as to starve the insects and expose them to birds, etc.

5. Drainage. Some insects prefer moist soil, in such cases drainage will render it unfit for them.

6. Fall plowing is injurious to many insects especially the wire worm.

7. Manure. The use of manure helps the plants and enables them to overcome insect attacks. Vigorous plants are more likely to escape than sickly ones.

If such an outline were followed, a portion being taken for each talk, the leading principles of economic entomology would soon become familiar. Then, particular insects might be studied, and the pupils be encouraged to work out the life history of some. Starting with the egg, and observing the different stages passed until the perfect insect is reached.

Would it not be an excellent plan to influence the directors of county fairs to offer prizes for the best collections of beneficial and injurious insects, or for the best case illustrating the development of an insect from the egg to the imago?

If our teachers, in rural schools, were to follow a course something like what has been outlined in this address, who could estimate the influence upon the rising generation of farmers? Teachers desirous to take up this work could readily secure bulletins and books that would serve their purpose admirably. The writer would not have pupils get books, but to depend entirely upon the instructions of the teacher and their own observations in the orchard and upon the farm.

Such study of the great Book of Nature would result in developing observation in young minds, something that is aided very little in our system of education among rural schools. No faculty in the young mind is so ready for development as observation, and yet how little is done to assist it. Nature furnishes material on every side in the country, and surely we should take advantage of it and early train our young to be close observers.

We have no doubt that the study of such subjects would increase the attractiveness of farm life, and serve to keep many a boy upon the farm who, with such surroundings as we find to-day, seeks the shadowy allurements of a home among overcrowded centres in town and city.

We hope the day is not far distant when the teachings of na ure will be better known in country sections, and that the boys and girls of our farming districts will see more in farm life than what some bemoan as drudgery; that they will see in it that which tends to health, peace, independence, and an ideal home; and that while they eagerly learn *how* a thing should be done, they will also know the reason *why*, so that practice and science, the handmaids of agriculture, will be more closely associated than in the past.

In the discussion which followed the reading of the paper, Dr. Bethune said that as he had been a school-master for six and twenty years he could well appreciate all that had been said, both by the President and Professor Panton, on the subject of teaching entomology in schools, especially in those situated in rural districts. Any one who tried it would be pleased and surprised to find how readily people in general are interested in subjects of this kind, even when they have not paid any attention to them before. And in the case of children, who are always curious about anything that attracts their attention, it is an easy matter to excite their interest and lead them to observe for themselves some of the wonders and beauties of Nature. He thought that the plan of devoting the last hour on Friday afternoons in country schools to talks upon Natural History was an admirable one, and he hoped that it would be widely adopted. He had formerly made use of this hour in a similar manner himself, but of late years the large increase in the number of subjects for the Matriculation Examination had rendered it impossible to spare the time. He thought that if country life could be made more interesting to the young people fewer of them would be so eager to abandon their farms and rush into the towns and cities.

Mr. John S. Pearce spoke of the valuable work of the Society, which he did not think was as generally known as it should be. He thought that more should be done, especially by paragraphs in the newspapers, to draw the attention of the public to the great benefits which the Society has been for years conferring upon farmers, fruit-growers and gardeners throughout the Dominion.

Mr. John Law moved a vote of thanks to Professor Panton for his excellent address to which he had listened with great pleasure. This was seconded by Dr. Woolverton, and carried unanimously. In putting it to the meeting the President (Mr. Dearness) spoke on the importance of training the powers of observation of children by bringing subjects of nature before them. The object would then become the teacher, and the school-teacher the interpreter.

The Rev. T. W. Fyles then read the following paper :

THE IMPORTANCE OF ENTOMOLOGICAL STUDIES TO AN AGRICULTURAL AND FRUIT-GROWING COMMUNITY.

Rev. Thomas W. Fyles, F.L.S., South Quebec.

It is wonderful proof of the wisdom and goodness of God that this earth, which He hath given to the children of men,* is so fitted and prepared that it affords scope and claim for the exercise of man's powers, and that man himself is so constituted that the employment of those powers is conducive to his well-being and enjoyment of life.

So true is this that though the fiat has gone forth—"Thorns and thistles shall the earth bring forth to thee. In the sweat of thy face shalt thou eat bread," it is also written, "Thou shalt eat the labour of thine hands. O well is thee, and happy shalt thou be."

In the vegetable kingdom materials in such great variety are so abundantly furnished, and man finds that he can, to so great an extent, select, transplant, modify and improve the plants producing them, for the supply of his necessities and gratification of his tastes, that he is stimulated to exertion, and comes to realize that he is, in a humble way, a co-worker with God ; and his work is ennobled to him by the thought.

And not only do men, whose very living depends upon their endeavours in the field, the garden, the orchard and the vine-yard, take an interest in rural occupations and their rewards ; "The king himself"—says the wise man—"is served by the field" ; and the devotes of Ceres, Flora and Pomona are to be found as well among the highly gifted and trained leaders of the public as among the hard-handed sons of toil. The most eminent statesman can take pleasure in a *primrose* or an *orchid*. The great Lord Bacon spoke of Horticulture as the "purest of human pleasures ; and the "Judicious Hooker," one of England's most learned and thoughtful divines, desired no higher preferment than a country cure, in which he might see God's gifts spring from the bosom of the mother earth.

It is the general interest in the productions of the soil, and whatever affects those productions, that is the *raison d'être* of the scientific associations fostered by our Department of Agriculture.

The task I have set myself is to shew the importance of Entomological studies to those who take an interest in the cultivation of the soil.

Entomology has to deal with "the locust, the caterpillar, and the palmer-worm"—God's "great army." So vast is this army that—to use the words of Dr. Lintner, the State Entomologist of New York—"it has been truthfully said that insects have established a kind of universal empire over the earth and its inhabitants. Minute as many of them are, and insignificant in size to other than naturalists, yet in combination they have desolated countries and brought famine and pestilence in their train." (First Report, p. 2.) Happily the hordes are duly apportioned. Each natural division of territory has its share. And there is such a marvellous arrangement of checks and counter-checks operating upon them that, as a rule, every kind is held in proper subjection.

The intentional or accidental transportation of an injurious species beyond the sphere of the operations of its natural foes sometimes occasions disaster.

Of the injuries wrought by imported insects we have had instances never to be forgotten, in the ravages of the Hessian Fly (*Cecidomyia destructor*, Say), the Cabbage Butterfly (*Pieris rapæ*, Linn.), the Colorado Potato Beetle (*Doryphora decem-lineata*, Say), the Larch Saw fly (*Nematus Erichsonii*, Hartig), the Gypsy Moth (*Ocneria dispar*, Linn.), and the Fluted Scale (*Iceryia Purchasi*, Maskell).

It must not, however, be supposed that all insects are injurious. Many species must be ranked among the cultivator's friends. Indeed, of the 25,000 named species of North American insects about 8,000 only can be regarded as pests.

* Ps. cxv, 16.

Some species are injurious in one stage of their existence and useful at another.

Our Hawk-Moths by dispersing pollen act beneficially for the fertilization of blossoms; but if unchecked increase were allowed them, their caterpillars would become terrible pests, and would destroy not only our fruit-trees but many of our shade and ornamental trees also. Their numbers are however kept down by various species of ichneumons belonging to the genera Ophion, Cryptus, Microgaster, Apanteles, etc. I have seen as many as 150 parasitic grubs issue from one larva of *Sphinx Kalmiæ*, A. & S. It can easily be conceived that foes so numerous and so deadly would soon exterminate the Sphinges altogether.*

This would be a pity for, as I have said, the moths of the family perform a useful part. They are moreover very beautiful, and

"A thing of beauty is a joy forever."—*Keats.*

But the checks are met by counter-checks. Of those 150 grubs that I have mentioned not more than two or three escaped the attacks of a secondary parasite, *Pteromalus tabacum*, Fitch. This last named insect is a brilliant little object that once seen can hardly be forgotten.

People are familiar with the idea of one grub feeding inside another grub; but it is not so generally known that there are insects that pass their early stages and attain perfection inside the eggs of other insects. Ashmead in his valuable work on the Proctotrypidæ, published in 1893 by the Smithsonian Institution, has given descriptions of forty-one such insects.

Then there are numerous kinds of ground-beetles, lady-birds, syrphus-flies, soldier-flies, dragon-flies, etc., predaceous on other sorts, and therefore beneficial to man.

The first point I make then is this:—*A knowledge of Entomology is important that men may rightly distinguish between their insect friends and their insect foes.*

In a paper which I had the honour to read before the Fruit Growers' Convention at Ottawa, I showed the important work done by Humble Bees in the cross fertilization of blossoms. These insects are so entirely beneficial that some of their kind have been—with a sort of grim propriety—transported to New Zealand to labour there for the public good.

But, at the very time that the Humble Bees are operating in the orchard for the fruit grower's benefit, there are a number of other insects at work that do a vast amount of harm, namely, the Bud-worms, Canker-worms, Leaf-rollers, etc. *The great remedy against all these hurtful insects is arsenical spraying.* But if this spraying be delayed till the blossoms are opened the nectaries will become clogged with the arsenite, and though the instinct of the bees may lead them to shun the poisoned blossoms, the good those insects would do will be left undone. *The first spraying should be given before the flower-buds are opened; the second after the fruit is fairly set.*

The Ontario Legislature passed a law in April, 1890, which says:

"Sec. 1. No person in spraying or sprinkling fruit trees during the period within which such trees are in full bloom shall use, or cause to be used, any mixture containing Paris green, or any other poisonous substance injurious to bees."

Promptitude in dealing with injurious insects is always of the utmost importance.

A patch of aphides neglected will spread and spread, till it covers a tree—a little one becoming a thousand.

The apple tree Aphis (*Aphis mali*, Fab.) lays its eggs in the fall; and Mr. F. M. Webster suggests that apple trees should be sprayed in winter (see 24th Rep. of the Ent.

* Let us suppose that the whole number of grubs mentioned would produce perfect insects, and that half of these would be females; then let us see what the natural and unchecked increase of these would be at the end of five years. A little figuring will shew that it would amount to the enormous number of 4,746,093,750.

Soc. of Ont., p. 90) for the destruction of the eggs. We should have to take an unusually mild time for such a purpose in this country! I dare say, however, that a spraying early in November, or early in the spring would be beneficial. Kerosene emulsion, made by violently agitating a mixture of two gallons of kerosene and one gallon of hot soap solution is prescribed as the remedy for use. It should be diluted with nine gallons of water (Lintner's 5th Rep., p. 161).

Late in the fall, or on favourable days in winter, the fruit grower can do good work by examining his trees and removing the egg masses of various species of injurious insects. A trained eye can readily detect the eggs of *Clisiocampa Americana*, Harris, Fig. 41. *Orgyia nova*, Fitch, *O. leucostigma*, A. & S., and the cocoons of *Platysamia Cecropia*, Linn., *Telea Polyphemus*, Linn., *Callosamia Promethea*, Drury, Fig. 42. etc. But in removing such as these he should be careful not to destroy the clustered cocoons of microgasters, nor the downy masses of those of *Apanteles longicornis*, Prov.—a species that is parasitic in the Tent caterpillars—for these insects are among his most valuable friends.

Fig. 41.

The destruction of every hibernated Potato Beetle in the early spring is the destruction of an incipient host. The potato plants should be sprinkled with Paris green as soon as they appear above ground.

A friend of mine when the beetles first invaded the province, and before it was quite known how they should be dealt with, broke up a piece of land in the very centre of his extensive farm, and planted it with potatoes, hoping that its isolation would secure him a good crop. One early day he went to the enclosure to see if the potato plants were shewing themselves. They were not; but to his disgust there was, to use his own words, "a durned potato-bug sitting on the fence, and awaiting for them to appear." His action in regard to that individual was both prompt and effective!

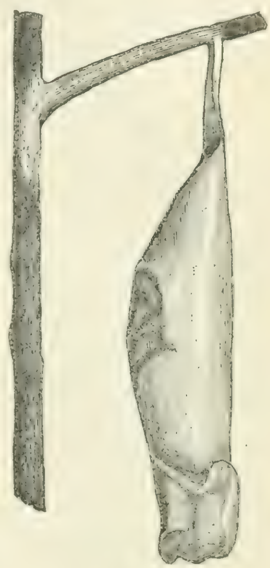


Fig. 42.

Gooseberry and currant bushes should be gone over with white hellebore *as soon as the leaf-buds begin to open.*

The eggs of many of our hurtful species are laid in patches, as for instance those of *Datana ministra*, Drury, which produce the yellow-necked apple tree caterpillars, and those of *Œdemasia concinna*, A. & S., which produce the Red-humped apple tree caterpillars, Fig. 43. The young broods of these may be found in July, each brood feeding on the *under side* of a leaf. The plucking and destroying of a leaf and its burden is easily accomplished.

The Round headed Borer of the apple tree (*Saperda candida*, Fab.), Fig. 44, is a

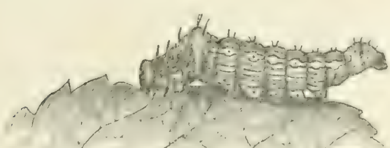


Fig. 43.

Fig. 44.

troublesome pest. Its native food plants are the thorn, the moosemissa and the shad-bush, but it takes far too readily to the apple tree. The perfect beetle appears in June,

and lays its eggs in the end of that month and in July. In June then is the time for the fruit grower to go over the stems of his young apple trees with a brush and diluted soft soap. He can give them a scrubbing at the same time if he likes. Sir Joseph Banks freed his apple trees from the American Blight (*Erisoma lanigera*, Hans.) by the use of the scrubbing brush alone (Kirby and Spence's Entomology, Letter VI.) The second point I make is :—THE STUDY OF ENTOMOLOGY IS NECESSARY THAT THE CULTIVATOR MAY KNOW HOW AND WHEN TO DEAL WITH HIS INSECT FOES.

The study of Entomology is profitable. What harm and loss have been averted by the making known of insecticides and how to use them! *But greater good is sometimes done by calling in the aid of friends than by direct attacks upon foes.*

The introduction of the Australian Lady-bird (*Vedalia cardinalis*, Mulsant) has probably saved the orange groves of California from extinction.

I have no doubt that if the parasite (*Diplosis grassator*, Fyles) which keeps down the numbers of the Philloxera in this country had been carried over to Europe it would have saved many a vine-yard that has disappeared.

The late Professor Riley introduced from Europe the species *Microgaster glomeratus*, which is a check upon the cabbage worm (*Pieris rapæ*, Linn.). The insect is figured and described in Wood's "Insects at Home," pp. 325-7. Wood tells us that "so rapidly does it multiply that after watching its progress from the larva to maturity, it seems strange that a single cabbage white butterfly should be found in the country." * * * "If a hundred cabbage caterpillars be captured, there will be only one or two which do not contain the larvæ of the microgaster."

Mr. A. D. Hopkins, of the West Virginia Agricultural Experiment Station, has lately introduced the European predaceous beetle, *Clerus formicarius*, Linn, to the United States; and it is thought that this insect will check the destruction of the spruce forests which has proceeded to such an alarming extent in that country. The clerid larva is the natural foe of the bark-boring and wood-boring larvæ. It searches them out and devours them with avidity.

As *Clerus formicarius* is a new importation to this continent, and is at present little known, a short description of it may be acceptable. The beetle is about three-eighths of an inch in length. Its head and the fore part of its thorax are black. The after part of the thorax and the base of the wing-covers are brick red. The remaining portions of the wing-covers are black crossed by two somewhat wavy, snow white lines.

The name Kleros was given by Aristotle to certain larvæ found in bee-hives. The trivial name *formicarius* was given to this species by Linnæus because of the ant-like form of the beetle. (See Wood's "Insects at Home," p. 138).

A knowledge of Entomology was necessary for the understanding of the habits of these predaceous and parasitic insects, and for placing them where they might work to man's advantage. And this bringing about of good by the direction of natural agents is only in its inception. As our knowledge increases we shall, in all probability, be able to direct and control forces that are at present but little understood. My third point is :—THE STUDY OF ENTOMOLOGY IS NECESSARY THAT THE AGRICULTURIST AND FRUIT GROWER MAY MAKE THE MOST OF THEIR INSECT FRIENDS.

The Americans—a practical people—are fully alive to the importance of entomological research. Their division of entomology in the Department of Agriculture; their national museum; their experimental stations dotted all over the Union: their numerous scientific commissions, with their reports and bulletins—all bear witness to this fact.

Our own authorities do not mean to be behind hand. The establishment of experimental farms, the encouragement given to scientific and economic societies, farmers' clubs and institutes, etc., the printing and distributing of reports upon practical subjects, betoken an enlightened policy on their part.

But notwithstanding all that has been accomplished, sufficient care has not, I think, been taken to reach the young.

In 1887, in a paper read before the Teachers' Convention at Sherbrooke, I advocated the cultivation in schools of a taste for natural history. The means I recommended to teachers were:

I. Conversations on natural objects; informal lessons; extempore sermons on texts from the book of nature.

II. The formation of school museums, libraries and gardens.

III. The giving of formal object lessons, each complete in itself, and bearing upon the purpose in view.

Examples of peripatetic lessons on natural history may be found in Gosse's "Canadian Naturalist" (which is now, I am sorry to say, out of print) and in "Country Walks of a Naturalist with his Children," Groombridge & Sons, London.

Hints for the formation of school museums may be found in a work written by a brother of a former rector of Quebec, and published by the S. P. C. K, viz.,—"The Story of our Museum," by the Rev. Henry Houseman, A.K.C.

We need some one to do for Canada what Miss Ormerod is doing for England to popularize Practical Entomology.

We need a hand-book on this subject, written after the model of that useful work "Spotton's High School Botany," for use in our public schools.

We need school wall-sheets, representing the most important of our insect friends and insect foes in their different stages, and giving a few brief particulars concerning them.

But it is time I brought this paper to a close. I will only say in conclusion that I know of no study more fascinating than that of entomology. It deals with objects of such exceeding beauty; the life histories it makes known are so marvellous that they tell like fairy tales; and, above all, the revelations that it makes to us of the Divine power, wisdom and goodness so lift our thoughts from earth to heaven that we are ready to exclaim with the Psalmist, "Oh Lord, how manifold are Thy works, in wisdom hast Thou made them all; the earth is full of Thy riches." Ps. civ. 24.

Mr. Wm. Lochead spoke very highly of Mr. Fyles's papers in the annual reports, which he always read with great interest and pleasure. He thought that the popularizing of the study of entomology in our schools would form another step in the progress and advancement of Canada. He then gave an account of the work that was carried on at Cornell University in connection with entomology and described the advantages to be gained from the lectures, and the practical work in the "Insectary," from such able teachers as Professor Comstock and Mr. Slingerland.

Mr. J. Law moved a vote of thanks to Mr. Fyles for his valuable paper, and was seconded by Mr. W. Scarrow, who spoke of the lack of mental interest in farmers, which might, he thought, be developed by education in entomology and the study of other natural objects, and in this way farm-work would become a pleasure instead of mere drudgery.

A very humorous paper was then read by Mr. Law, in which he gave amusing descriptions of the experience he had with ants and other insect pests during a residence in Cuba; he related an attack which he witnessed of a large spider on a humming-bird, and spoke of the size and beauty of the fire-flies and the profusion and variety of insect life in the tropics.

The meeting adjourned at 10.30 p.m.

THURSDAY, October 22nd.

MORNING SESSION.

The society met at 9.30 o'clock, the President occupying the chair, and proceeded with the reception of the reports of the several sections of the society and other matters of a business character.

The following report of the Geological Section was read by its secretary, Mr. John Law:—

REPORT OF THE GEOLOGICAL SECTION OF THE ENTOMOLOGICAL SOCIETY FOR THE YEAR 1895-6.

The members of this section beg to submit the following report for the past year:

Regular meetings were held weekly during the year, with a fair attendance. There has been no great increase of membership, but we look forward to our future place of meeting in the new building of the Y. M. C. A. as a means of stirring up our members to increased action in matters relating to the mineral wealth of our country and the welfare of the local section.

Additions have been made from time to time to our individual collections obtained from trips to outside places during the season. Our hopes for forming a central collection have not yet materialized owing to the failure of the effort to obtain the only rooms suitable for that purpose in the new public library building. This Section is pleased to state, however, that a collection of minerals has been presented to the free library, through the influence of Sir John Carling, by the Dominion Government. It is now accessible to our members, having been recently arranged and classified by the chairman of the section; this is putting into effect what was suggested in our last year's report, viz., "That it would be a great advantage to students of mineralogy if some steps could be taken by which the small number of geological and natural history societies in the Province could be provided with suitable collections of accurately named specimens of the chief economic minerals of the Dominion." A collection of minerals at the Western University is also available.

A number of places of geological interest have been visited by one or more of our members during the past season. A stroll through the Niagara district from Grimbsy to Hamilton afforded a collection of fossils from the prevailing rocks in that vicinity, viz., Niagara, Clinton, Medina, the upper Silurian formation. Other places visited were Owen Sound, Kettle and Stony Points (Lake Huron), Forest, St. Thomas, Sault Ste. Marie, Petosky, St. Ignace and Mackinac Island (Michigan), and Bruce Mines on the north channel.

Collections were made from each of these locations, affording the section plenty of new material for the coming winter's work. Valuable papers have been read from time to time before the section on natural history, astronomy and physiology. Some four to five lectures were also given on psychological subjects by the Rev. Mr. Falling.

A number of second year students of the Western University are also taking up the study of geology and mineralogy with the section.

Signed on behalf of the Geological Section by

S. WOOLVERTON, Chairman.

JOHN LAW, Secretary.

REPORT OF THE BOTANICAL SECTION OF THE ENTOMOLOGICAL SOCIETY OF ONTARIO.

In presenting their annual report the Botanical Section have pleasure in stating that the work of the year has been on the whole satisfactory and encouraging.

The meetings have been well attended, interesting and profitable, the new members especially showing an unusual interest in the work.

Meetings were held regularly every Saturday from the 1st May till the middle of July, after that the absence of many members on holiday trips and other uncontrollable circumstances interfered much with our meetings.

The work of the section was arranged so that the more advanced was taken one Saturday, and instruction classes in the more elementary work the next Saturday, the senior members taking turns in directing the examination of types of the common orders collected by the members.

The outings this year were mainly to localities near the city—one exception being a very pleasant trip to Woodstock and neighborhood, where the section were very hospitably entertained by Mr. Thos. P. Hart of that district.

Rare specimens obtained were *Orchis rotundifolia* and *Ophioglossum vulgatum.*

It is believed that the removal to more commodious rooms in the new Y. M. C. A. building will place the section as well as the society and their objects more prominently before the citizens, and result in a greatly increased membership, and consequently usefulness of both.

The section, while congratulating its ex-secretary, Mr. W. T. McClement, M.A., on his appointment to an important position in the Armour Institute, Chicago, regrets his removal from London. When he left he had tabulated the flora of London and environs as far as the Compositæ. This important work will be carried on by the section during the coming season.

A. Hotson, M.D., Secretary.

REPORT OF THE MICROSCOPICAL SECTION OF THE ENTOMOLOGICAL SOCIETY.

Under the leadership of Mr. Rennie, the Microscopical section has had a year of continued success. The interest of members has kept them diligent in the good work. Notwithstanding the drawbacks consequent upon the poor position of our meeting place, the attendance has been well sustained. We think that in no year have we had more interesting subjects and never have they been presented with greater ability.

Meetings began on October, 11th, and were held each alternate week till April, 17th, when this section closed its meetings in favor of the Botanical, these two sections covering the year between them. We had but one meeting open to the public. This was well attended and general satisfaction was expressed at the many wonderful and beautiful objects under the microscopes.

The subjects studied during the year were as follows:

Desmids.—Their history, structure, distribution and classification, with drawings. These were illustrated by a large variety of specimens. Led by the Secretary.

Crystallography.—Specially as it applies to minerals, with specimens viewed both with and without polarized light. Led by Dr. Wolverton.

The Perisporiaceae.—Practical classification by members. Led by the Secretary.

Chemical Staining of Vegetable Tissues. Led by Dr. Hotson.

Mosses—Their history and dissection. Alternation of Generations, etc. Led by W. T. McClement, M.A.

Bacteriology. Led by Dr. Neu.

Photo-micrography. Led by Mr. Rennie, who had apparatus present and produced a very fine photo-micrograph of a small insect.

Seeds and their microscopical appearance. Led by Mr. Balkwill.

The relations between Gymnosperms, Cryptogams and Angiosperms. Led by Prof. Dearness.

Animal Hairs.—The significance of their structure, accompanied by a large number of mounts. Led by Prof. W. E. Saunders.

This section has suffered during the year by the loss of two of its active members, Mr. J. M. Denton whose removal by death we all deeply mourn, and Mr. W. T. McClement, M.A., whose home is now in Chicago.

We look out upon another year with anticipations of greater usefulness than we yet have had. The new rooms which we are to occupy will give the Microscopists an opportunity, such as they never have had, of coming under the public eye. It is the intention of this Section to infuse renewed zeal into their work. The wonders the microscope reveals as well as its delights are almost unknown to the public, and it is our purpose to make our meetings more popular during the fall and winter months.

JAS. H. BOWMAN,
Secretary.

The following paper was then read by Professor Panton, who prefaced his remarks by suggesting that a paper should be written by some one connected with the Society setting forth the advantages of the study of Economic Entomology. He spoke also of the necessity of making the work of the Society better known throughout the country and advised the publication of an abstract of the Annual Report in the daily papers. He also recommended that the conductors of county exhibitions should be urged to offer prizes for the best life-history of injurious insects, with specimens illustrating its various stages and modes of operation.

TWO INSECT PESTS OF 1896.

BY PROFESSOR J. HOYES PANTON.

During July of 1896, the attention of the public was, almost, daily directed to a newspaper item referring, either to the "Army Worm" or "Tussock Moth."

The former appeared in many parts of the Province or Ontario; and, in some places, destroyed considerable grain; the latter, was confined to the City of Toronto; where it did much damage to ornamental trees in different parts of the city. The writer having had the opportunity of visiting several of the infested districts, has thought it expedient to place before the Entomological Society of Ontario the results of his investigations.

THE ARMY WORM.

Leucania unipuncta.

We find the army worm reported as present in the township of Eldon, Victoria county, in August 1833, and, common in many places throughout Ontario Province in 1861.

In July, 1894, it did considerable damage in the counties of Lambton and Victoria.

MAP SHEWING
THE
DISTRIBUTION OF THE ARMY WORM
IN ONTARIO
1896.

The Black portions are the infected districts.

The first notice received at the Agricultural College of its appearance in the Province of Ontario this season, was, in a letter from Marshville, county of Welland, dated July 3rd. On that date, Mr. J. Reavley, living near Marshville, sent some of the worms and a letter describing the attack. The writer visited Mr. Reavley's farm on July 9th, and several others in the townships of Wainfleet, and Humberstone the next day. Throughout the month, letters were daily received, announcing its arrival at different places throughout the Province of Ontario. On the 8th of July, the caterpillars appeared in an oat-field at the Agricultural College, by the 11th, they were very numerous, and reached their maximum on the 15th. From that date a perceptible decrease was daily observed, so, that by the 18th, only a few remained. They began to pass into the pupa stage on the 14th, and, the first moth was observed on 29th of July. Circulars were then sent out, with a view to learn something of the distribution of the army worm at this time; the damage done by it; the means employed to check its progress; and the length of time the caterpillars continued. About 450 replies were received from different townships, throughout the Province.

The accompanying map shows the distribution of this insect pest in Ontario during 1896.

The counties reported as infested are as follows:

Essex (5); *Kent* (8); *Elgin* (6); Norfolk (3); *Haldimand* (4); *Welland* (4); Lincoln (1); Wentworth (1); Peel (1); York (3); Ontario (1); Durham (3); Northumberland (1); Hastings (1); Lennox (1); Frontenac (2); Leeds (4); Dundas (1); Russel (1); Carleton (1); Renfrew (2); Parry Sound (1); Muskoka (5); *Simcoe* (6); *Grey* (6); *Bruce* (5); *Huron* (5); *Lambton* (7); Middlesex (4); Oxford (5); Waterloo (2); *Wellington* (5); Perth (3); Cardwell (1); Dufferin (3); Victoria (1); Peterboro (2); Algoma (1); Manitoulin (2); 39 counties and 118 townships.

The counties written in italics are referred to by observers, as suffering considerable loss. The figures after each county indicate the number of townships reported as infested. In many places the damage was slight, as the worms were too late in arriving to do much harm, owing to the advanced condition of the crops attacked. Early sowing is evidently favorable to an escape from disastrous results by an invasion of this pest. Of the crops attacked, oats suffered most; they seem to be a very attractive food for this caterpillar.

From a count made of crops reported attacked, 58 per cent. were oats, 20 per cent. corn, 16 per cent. wheat, and 5 per cent barley. Some observers report a loss of 50 per cent. in oat-fields, while in most of the other cases the damage was comparatively slight. There were a few cases reported in which almost the whole crop was destroyed In one oatfield at the college 50 per cent. of the crop was destroyed. In this case the worms were in all parts of the field before being discovered, and no measures could be adopted to stop their ravages. In most cases the attack did not continue longer than two weeks, in several, it lasted but a few days, and very seldom lasted longer than three weeks.

Several worms are known as the "army worm," but the true one is that which has appeared in so many parts of Ontario during the month of July, 1896. It seems also to have been common in several parts of the United States about the same time.

A despatch in one of our daily papers, dated, Washington, July 16th, reads: "Reports to the agricultural department indicate great ravages by the army worm, in all states from Maine to Wisconsin. The pests have been particularly destructive in New York, Massachusetts and Pennslyvania; there is no doubt that the losses will foot up into the millions." In New York State it appeared in 48 counties, and is reported, as the worst invasion in the history of the state. They were, also, common in Ohio and Illinois.

As grain crops were well advanced before its arrival, in many places of Ontario, the damage done was much less than it might have been. The attack, though in many

counties, was usually confined to small areas in each case, so that on the whole, the loss was not great.

The army worm (figures 45 and 46) is not at all a rare insect, and, from time to time, appears in Canada and the Northern States. We find it referred to as far back as

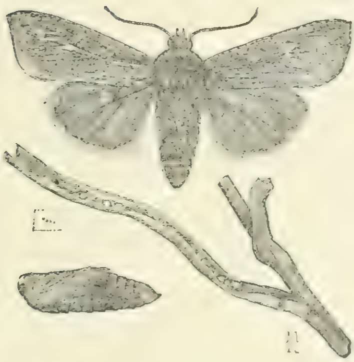


Fig. 45. Eggs, larva, pupa, imago of the army worm (*Leucania unipuncta*).

Fig. 46.

1743, 1861 is known as, "the army worm year," in the United States. During that year it received considerable attention and study. In 1869, it was quite common, also in 1872; 1875 was a bad year, and in 1880 it attracted much attention. The years 1861, 1875, 1880, are those in which the insect seems to have demanded most attention.

The moths are hatched from small, round white, *eggs* laid on wild, or cultivated grasses, and sometimes on grain along the inner base of the blades, where they are doubled, or, between the stalk and its surrounding sheath. The rankest tufts of grass seem to be preferred, but, in some cases, the eggs are found on pieces of cornstalk, and they have been found upon spring and winter grain.

In one of the worst attacked oat fields, at the College, there were many old cornstalks from last year's crop; these, likely, afforded a suitable place for eggs, and this explains the sudden appearance of the caterpillars in all parts of it. This field was the first attacked, and from it many of the catterpillars appeared to have come, in this they were not confined to the edges, as was usually the case in the other fields. The eggs appear to be laid in the evening, or early night. They are deposited in rows, 15 to 20 in a row, on the folded leaf, which serves to conceal them. One female may deposit from 500 to 700 eggs, and seldom takes longer than two or three nights to do so.

The eggs hatch in about a week after being laid. The young caterpillars, in the first stage, can drop by means of a thread, and move with a loop-like motion. At this time, they are of a light greenish color, and thus resemble the plants on which they feed, and escape the notice of their enemies. The *larva* passes through five moults, at intervals of three or four days until it reaches the sixth stage, and is fully developed in about four weeks. The caterpillar is about one and a half inches in length, of a dark gray color, with blackish stripes, and numerous white lines along the back. In many specimens examined by the writer, comparatively few were light colored, until about the close of the attack, and then, the light ones were much more common. Some claim that the dark color is due to exposure. The length of time before complete development of the larva is reached depends a great deal upon temperature, and may vary from 16 to 28 days.

The mid-summer brood usually takes a shorter time than that of the fall. During the day they avoid the rays of the sun by hiding under clods, pieces of boards, chips, etc., and about 5 p. m. they emerge to feed.

In making observations about noon with Mr. Reavley near Marshville, we were surprised that so few worms could be seen at that hour, in a field badly attacked.

But on turning over sods among the oats, we found them in great numbers. We counted over 30 occupying a space no larger than the hand, and, in some parts, more than 50 to the square foot.

In a small patch of late oats on the Reavley farm scarcely a blade was left. The worms abandoned the ripening oats near by, and congregated upon the patch of late oats, no doubt, because they were more succulent.

Every stalk had from one to five worms upon it, and many were eaten to within three inches of the ground. They feed chiefly during the night, and sometimes in cloudy weather. Where they are in great numbers, they make a peculiar sound, which can be heard distinctly, while they are feeding, and cutting off the stalks and heads of grain. Under ordinary conditions, they do not travel, but live much as many other species of the cut worm family do (Noctuidae) to which they belong feeding by night, and hiding by day. However when food becomes scarce, they then undertake to march for new feeding grounds.

They stop at no obstacle, death only will make them halt. A piggery at the college impeded their progress for some days. They never attempted to go around it, but in vain tried to scale its walls, and kept constantly dropping, yet always ready to try the ascent again.

From observations made, as to this rate of travel, while crossing the lane between two fields they were seen to move two feet a minute (40 yards per hour.)

With us they usually appeared active from 4 o'clock p. m., and after that continued to move in great numbers, in all directions, and not in a definite line of march. While feeding, they devoured the leaves and then nipped off the head, which falling to the ground was no longer touched. In attacking some bearded wheat they nibbled off the awns, and only partially fed upon the grain. Oats, timothy, wheat, rye, and barley are their favorite plants; they also feed readily on corn, if young and tender; but they seem to have no inclination for any plants not in the order *gramineae* unless forced by hunger. In a hay field, they will leave the clover and devour every plant of timothy. Several of our fields had excellent crops of young clover; these were left untouched, while the oats and wheat were continually fed upon. In bringing some caterpillars from Humberstone, pea plants were put in the box with them for food, but they were scarcely touched in two days.

The following are results reached during our observations regarding the plants upon which they feed, oats, barley, wheat, and corn they readily devoured.

Clover. This was eaten very sparingly and was left if wheat or oats were introduced into the boxes containing caterpillars. Clover was put in the boxes on Monday, by Tuesday night it was hardly touched, but they began to feed upon it on Wednesday. They ate it, only when nothing more attractive was obtainable.

Lucerne. This seemed less attractive and was not touched until Thursday. Clover, beans and lucerne were put in the same box; all were avoided at first, but, as hunger increased, the beans were first eaten, then clover, and lucerne last. Beans in the box were not touched till Wednesday.

Peas. They were not touched for two days. In a field sown with oats and pease, the latter were not attacked, as long as the oats remained.

Turnips. These were left untouched for a day; as soon as a leaf of corn was put in the box, the turnips were at once deserted. A turnip field bordered one of the infested oat fields; the caterpillars in leaving the latter passed through the former without feeding upon a single plant.

Potatoes, were left untouched in the boxes.

Mangels adjoining one of the invaded fields escaped damage, though caterpillars were constantly passing over and among the plants. In the boxes they were slightly nibbled.

Beets remained untouched for three days.

Buckwheat was taken after a day's fast, when nothing else was presented; but as soon as corn was added they immediately left the buckwheat to feed upon it.

Carrots escaped for a day, but in two days were fairly well eaten. They would not touch carrots in the presence of grass or corn.

Cucumber vines were preferred to beans, and were almost as readily eaten as some corn leaves.

Celery was continually avoided, and the worms began to devour one another before they would feed upon it.

Maple leaves were avoided, but some apple were sparingly fed upon, after two day's fast.

Grape leaves were taken, when no other food was present.

Strawberry leaves remained untouched till the third day.

Currant leaves were avoided for three days and then eaten, but sparingly.

Canadian thistles remained untouched.

When no food was put in the boxes containing caterpillars, in 24 hours they began to devour one another. Frequently in boxes containing unattractive food, heads were found among the leaves, these no doubt belonged to bodies that had been devoured by the survivors.

From these experiments, it would seem that the food of the Army worm is largely restricted to the *gramineæ*, and that they will not feed upon plants from the *leguminosæ* and some other orders unless pressed by hunger. Consequently, there is little fear of any other farm crop being attacked than oats, wheat, timothy, rye, barley and corn.

Having become fully developed caterpillars at the end of three or four weeks from the time of being hatched, they pass into the ground, just below the surface or under stones, clods, etc., and enter the *pupa* stage. In a field at the College many pupa cases were found in cracks in the soil.

This condition lasts two weeks, and then the perfect insect (*imago*) emerges from its pupa case.

The moth is fawn-colored, with a small white spot near the centre of each front wing. The wings when spread measure one and a half inches across.

It conceals itself during the day and begins to fly towards night. Many could be seen flying around the electric lights in Guelph about the second week in August. The female has a more pointed abdomen than the male and her antennæ are smoother, and less hairy, than those of the male.

The moths feeding on flowers are more likely to be found near low ground, and hence they appear to come from such places. There appear to be three generations represented in a season or two broods in a year; the first wintering as larvæ, the second forming the "Armies," and the third larvæ derived from these after the imago has been developed; the last wintering as larvæ. The army worm usually winters in the larval form, but sometimes as the moth.

In the vicinity of our fields at Guelph, where the caterpillars were so numerous, we have as yet (Oct. 18th) failed to find any of the second brood.

The following stages (taken from Riley's report 1882) in the life history of an Army worm gives a good idea of the length of time that elapses in passing from the *egg* to *imago*. *Eggs* laid May 4th, hatched May 11th, 1st moult May 17th, 2nd moult May 20th, 3rd moult May 23rd, 4th moult May 26th, 5th moult May 29th: *pupa* June 2nd, *imago* June 17th.

At the College the first caterpillars were observed on the 8th of July; on the 9th there was a preceptible increase, 12th a marked increase; 13th large numbers; 14th, 15th still very numerous; on the 16th a perceptible decrease; 17th the decrease quite marked; 18th, 19th comparatively few; 20th only a few stragglers could be seen, and, most of these, were light colored. Towards the close of the attack, a bacterial disease seemed to destroy some of them. It is a matter of surprise to many how these caterpillars appear and disappear so suddenly, but a little reflection upon their life history explains the mystery.

Hidden in the grass by day, and feeding at night, they escape observation. If one or more dry seasons come, they multiply rapidly. Large numbers winter in the larval condition, and during the following spring moths appear and lay many eggs, which hatch and give rise to innumerable caterpillars which from a scarcity of food are forced to "march" and thus become suddenly conspicuous. These develop, pass into the ground to enter the pupa stage, and thus disappear suddenly.

Dry weather seems favourable for their development. Consequently a dry season, followed by a mild winter, and a dry summer, as in 1895, and 1896, supplied conditions very suitable for increase of the army worm in many parts of Ontario.

Having referred to the distribution, and life history of this insect, and some of our investigations in connection with it, we may now direct attention to some of the means by which it is, and may be prevented from being a source of alarm.

Natural remedies. The army worm has many enemies; nearly all insectivorous birds relish it as a sweet morsel, and are ready to feed upon it the moment it becomes conspicuous. In Guelph, this season, the English sparrows congregated in great numbers, where the caterpillars were numerous, and fed voraciously upon them In some parts of the United States the bobolink is called the army worm bird.

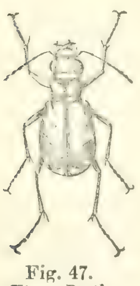


Fig. 47.
Tiger Beetle.

Fig. 48.
(*Calosoma calidum.*)
[After Riley]

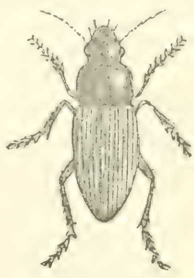


Fig. 49.
Ground beetle (*Harpalus caliginosus*)
[After Riley.]

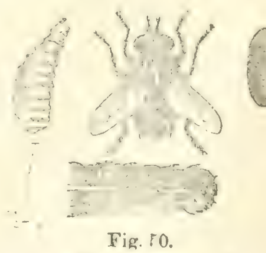


Fig. 50.
Nemoraea leucaniae.

The ground beetles, *Calosoma calidum*, fig 48, and *Harpalus calignosus*, fig 49, especially the former, were very numerous in the infested fields. Tiger beetles (*Cincin-*

delidæ) fig 47, also prey upon them. But, probably, one of the greatest insect friends to assist in destroying the army worm is the red tailed tachina fly (*Nemoræa leucaniæ*) fig. 50. In the infested fields of Wainfleet near Marshville, the writer found many of the caterpillars, bearing the eggs of this insect upon them. In some cases, several eggs upon a caterpillar, and the flies themselves buzzing around. At the college we seldom saw more than a single egg upon a caterpillar and this was usually near the head, in a position not easily reached by the worm to tear it off. We succeeded in developing quite a number of the flies. Shortly after the egg is deposited it hatches, and the small white grub bores into the worm (host) and feeds upon it, developing at the expense of the host's life. At first, none of the minute white eggs of the fly could be seen, though many caterpillars were examined, but in a few days, some were observed which indicated that a benefactor had arrived. This beneficial insect resembles a large house fly, but has a red tip at the end of the body. The first one appeared in our breeding cages Aug. 4th; the first army worm moth July 29th. Some observers have seen the yellow-tailed tachina fly (*Tachina flavicauda*) preying upon the army worm.

While developing the caterpillars we succeeded in securing several specimens of *Ichneumon leucaniæ*, another parasite, and one of *Ophion purgatus.*

Altogether, investigators have found some twenty different species of insects that attack and assist greatly in destroying the army worm.

It will thus be seen that the moment these insects emerge from their hiding places in grass fields, they are pursued by a host of relentless foes in the form of birds, predaceous beetles and parasitic flies.

Artificial remedies. 1. As this insect breeds largely in rank grass, such as is seen bordering swamps, it is well, where practicable, to burn such in the fall or spring. Clean cultivation, and the keeping of fence corners, etc., clean, should be followed, as far as possible.

2. Where the worm has appeared its progress may be stopped by plowing a furrow with its perpendicular side next the field to be protected, or a ditch may be dug in the same position. Holes dug at intervals of ten to fifteen feet, in the furrow or ditch will be useful in catching the worms, failing to climb the sides, and wandering aimlessly along the furrow. The worms collected in the furrow or ditch may be destroyed as follows: (a) Plowing a furrow, so as to bury them; (b) Sprinkling coal oil upon them; (c) Scattering straw over them and firing it; (d) Dragging a heavy pole along the ditch.

3. Where Paris green may be safely used a strong mixture (one pound to seventy-five gallons water) sprayed upon the plants likely to be first attacked will be effective. Windrows of green oats sprinkled in this way in the line of march will destroy myriads as they feed upon their favorite food. At the College immense numbers were destroyed in this way in a short time. By actual count made by the writer July 18th, 2,560 dead worms lay on a single square foot beneath the windrows.

4. Sometimes, conditions are such, that great numbers may be crushed under a roller.

5. Windrows of straw sometimes afford a place of concealment for the worms, and may be fired so as to destroy many beneath them.

6. Some recommend spraying several times a day with kerosene emulsion, a strip of ground over which the insects are passing.

Frequent reference has been made in newspapers to the use of salt or lime as an effectual barrier to their progress. We experimented with both, and found that in each case the worms moved over and through the lime and salt, apparently without the least difficulty.

Tussock Moth.

Orgyia leucostigma.

The Tussock moth is another insect pest which has attracted considerable attention during July, 1896. Though not widespread in its attack, it has occupied considerable space in the newspapers.

Its ravages have been largely confined to the defoliation of shade trees in the city of Toronto, and hence, appearing at a place where important daily papers are published, it received much notice.

Although in Toronto this caterpillar confined itself largely to an attack upon the horse-chestnut trees, yet it feeds upon the foliage of other trees. It has been found doing much injury to the elm and apple, and also feeding upon the plum, pear, maple, oak, walnut, butternut, locust and spruce. Few, if any trees, are exempt from its attack. It made its appearance in Toronto about July 1st, and remained for about three weeks, during which time it defoliated many of the horse-chestnut trees on Jarvis street, College avenue and in some other parts of the city. The writer visited the city July 27th, and had an opportunity to investigate its ravages.

This insect is readily identified in all its stages—*egg*, *larva*, *pupa* and *imago*.

Fig. 51.

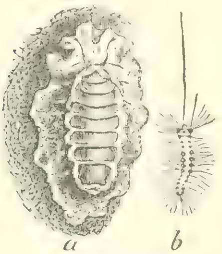


Fig. 52.

Fig. 53.

Fig. 54.

Orgyia leucostigma. *a* Adult female on cocoon. *b* Young larva. *c* Female pupa. *d* Male pupa. *e* Adult male (after Riley).

The eggs appear in masses (400-700) covered with a froth-like substance, that dries and hardens upon them, and serves to protect them from injury by the weather (rain), predaceous insects, and even birds. This covering is very white, and thus renders the

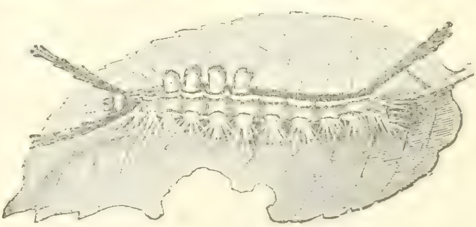


Fig. 55. *O. leucostigma*, full-grown larva (after Riley).

egg masses quite conspicuous at a considerable distance where they are deposited. These masses may be found on the trunk of the trees, in crevices of the bark, on the larger limbs, or in sheltered spots, such as fence boards and on bunches of dead leaves hanging upon the tree. In Toronto, the trunks of the horse-chestnut trees attacked presented in some cases quite a spotted appearance, from the innumerable white masses of eggs and cocoons attached to the bark.

As soon as the *eggs* hatch, tiny *caterpillars* (fig. 51, *b*) make their appearance (usually about June), and, as development proceeds, they pass through a series of molts, three—(one

a week). After the third, the larva (fig. 55) presents all the striking characters which make it so readily identified. The head, and the spots on the 9th and 10th segments are a bright red color: the back is black, with yellow lines along the sides: the body is sparsely covered with long, pale yellow hairs, giving the caterpillars a yellowish appearance. Four cream colored dense tufts of hair form a row upon the back of the 4th, 5th, 6th and 7th segments: while from each side of the head a long black tuft extends forward, and a single one projects backward from the posterior end of the body.

The young caterpillars soon after hatching scatter over the trees, feeding upon the leaves; when disturbed, they drop by a silken thread to the ground, wander about, many ascending the tree again.

Having reached full development, which takes about six weeks, during which they have reached a little over an inch in length, they enter the *pupa* stage (figs. 52 and 53), which lasts less than two weeks. The cocoon of the male is whitish, or yellowish, and very thin; while that of the female is much larger, of a gray color, and firmer texture. The male chrysalis is brownish, and shows rudimentary wings: the female is much larger, and shows no wing sheaths.

The cocoons may be found in crevices of the bark on the trunk, and large limbs, or in sheltered spots near where the caterpillars have been feeding. In Toronto the trunks of the trees were in some cases almost covered with them, and very many could be found beneath the window sills and the top boards of fences.

In about a week the *imago* appears. The male moth (fig. 54) is winged, and measures about 1¼ inches across the expanded wings; has feathery antennæ and very hairy front legs. The general color is ash-grey; the front wings are crossed by heavy bands of darker shade, with two black markings on the outer edge, near the tip, and a white spot on the inner edge, also near the tip. The writer succeeded in getting very few of the males, but numerous females.

The female (fig. 51) is wingless, of a pale gray color; short antennæ, not feathered. She is scarcely able to walk. Soon after emerging from the cocoon she begins to lay her eggs upon the old cocoon, and covers them with a frothy substance; as soon as this is done her life work ends, she drops exhausted and dies. The winter is usually spent in the egg stage, when clusters of them may be seen upon the trees.

Much depends on the season whether there will be one or two broods (a brood occupies about two months in completing its development).

Natural remedies.—Very few birds care to swallow this hairy caterpillar; the only ones that seem to feed upon it are the robin, Baltimore oriole, and the yellow-billed cuckoo. Some bugs (*Prionidus cristatus*) occasionally attack it. A large number of parasites follow in its trail, and do good work in checking its increase.

A great many ichneumons (*Pimpla inquisitor*) developed among the cocoons brought from Toronto for further examination.

Two Tachina flies also were developed in the cages. They resembled those of the army worm, but were smaller,

Artificial remedies.—1. Spraying with Paris green mixture (1 lb in 150-200 gallons of water) will destroy the caterpillars feeding upon the leaves. If there is any danger of injuring the foliage, 1 lb. to 160 gallons of water, to which is added 1 lb. of quicklime, may be used.

2. Gather the eggs in winter, as they are very conspicuous at that time, and may be readily destroyed.

3. Bands of adhesive material may be painted around the trunk. These will prevent the caterpillars ascending the tree.

This caterpillar, though capable of doing much injury, is not considered to be a difficult one to control. Spraying as above is very effective, and this followed by collecting and destroying egg masses when the leaves have fallen, cannot fail to be successful.

In the case of the attack at Toronto, active measures were not adopted until the caterpillars had almost completed development, and were about to enter the pupa condition.

Energetic efforts were then put forth to destroy the innumerable cocoons that were soon visible. No doubt thousands of egg masses were destroyed upon the trunks of the trees, in the work of rubbing the bark with a coarse brush. At first a band of adhesive material was painted upon the trunks, and thus many caterpillars were prevented reascending the tree, but as soon as cocoons were discovered, this method was abandoned and that of destroying the cocoons followed. It will be well for those interested to be on the watch the coming season, and if caterpillars appear, at once resort to spraying. During the winter all egg masses should be destroyed as far as possible.

Dr. Bethune thought that the Society should be congratulated upon being favoured with so valuable a paper as that to which they had just listened. There could hardly have been presented a more complete life-history of these two species of injurious insects and he was sure that its publication in the Annual Report would prove most useful to a large number of readers. He then proceeded to give his experience of the army-worm this year. (See his paper, Notes on Insects of the year 1896, page 55). At the recent meeting of the American Association of Economic Entomologists held in Buffalo, N. Y., in August last, at which he and Dr. Fletcher had the honor of representing the Society, the army worm formed one of the most conspicuous features among the reports on the season given by many of the members present. Dr. Lintner, State Entomologist of New York, reported its occurrence in forty-eight out of the sixty counties in the state, and considered it the worst insect attack in his experience. Mr. Kirkland stated that it had been very abundant and destructive in Massachussetts, especially to cranberry plants; he estimated the damage done in that state alone at $250,000 at least. In New Jersey, Prof. J. B. Smith had found it numerous in isolated fields, but did not consider that very much damage had been done. Mr. Johnson reported that it was very destructive in Illinois, but its numbers were materially reduced in June, by a fungous or bacterial disease which spread rapidly among them. Prof. Duggar had observed the same thing in Minnesota and considered that the disease was similar to the febrine of silk-worms. Prof. Webster considered that the chinch-bug was the worst insect of the year in Ohio, but the army-worm came second, and was very abundant and destructive. From all this testimony it was evident that the army-worm was wide spread throughout the states adjacent to Ontario; he did not, however, think that we need dread a very serious outbreak next year, as experience taught us that natural enemies so reduced their numbers as to make their ravages insignificant in the year following one of great abundance, nevertheless it would be well to instruct the farmers that their ground should be well cleaned up, and plowed up as far as possible in the fall in order to destroy the hibernating insects.

The Rev. T. W. Fyles regarded Prof. Panton's paper as a very valuable one to the community, and was personally grateful for the information it contained. He came from England to Canada in 1861, which was an army-worm year, and while visiting a friend at Côte des Neiges took a walk into the country. On his way he noticed a high wall around the college grounds on which was a broad black stripe of tar about three feet from the ground. This struck him as very remarkable, and on asking passers by what it was for, he could get no information. Subsequently he learnt that it was intended as a barrier to keep out the army-worm, and no doubt it proved a very effective check. He thought that a roller might be used with great advantage when the worms were crossing a hard surface, such as a road or lane. The tussock moth he had not found in Quebec until three years ago, when it became very abundant and the willow-trees were covered with the caterpillars. Another closely allied species, *Orgyia nova* had always been oommon in that province.

Mr. Dearness, the President, discussed the question of the migration of the army-worm from marshy lands in dry seasons and mentioned some instances in confirmation of this view.

Mr. H. H. Lyman then read a paper on "The preparatory stages of *Erebia epipsodea*, Butler." (See *Canadian Entomologist*, volume xxviii, November, 1896, pages 274 278.)

Mr. Lyman also presented a paper on some remarkable aberrations in *Colias philodice* and *Vanessa antiopa*, and exhibited the singular specimens referred to. Those of the former species were taken by Mr Dwight Brainerd, of Montreal, at Edgartown, Mass., in August last. (See *Canadian Entomologist*, volume xxviii, December, 1896, pages 305-6.); the suffused black specimen of *V. antiopa* was captured in British Columbia.

Election of Officers.

The following gentlemen were elected officers for the ensuing year: (See page 2.)

AFTERNOON SESSION.

The meeting was called to order by the President, Mr. J. W. Dearness, at 2.30 o'clock p.m. The following paper was then read by Dr. Bethune:

NOTES ON INSECTS OF THE YEAR 1896.

By Rev. C. J. S. Bethune, Port Hope.

The Army Worm.

The season of 1896 is chiefly remarkable, from an entomological point of view, for the outbreak of the army worm in this Province of Ontario. The insect, in its winged state at any rate, has long been familiar to every collector and is every year more or less abundant. We have all read accounts from time to time of its ravages in various parts of the United States, but hitherto we have been free from any serious invasions in this country. As this year's outbreak is being fully discussed by others, I shall merely mention what has come under my own observation.

On the 17th of July I received the following note from the Rev. Stearne Tighe of Emerald, Amherst Island: "I send you to-day by mail, specimens of a grub that is destroying all grain, etc, on this Island. What is it? Is there any way of destroying it, or arresting its ravages? This Island contains 15,000 square acres, and is at its nearest point two miles from the mainland." I at once recognized the specimens to be the notorious "army-worm" (*Leucania unipunctata*), which had already been reported in the newspapers as having appeared in injurious numbers in various parts of the province. I immediately wrote to Mr. Tighe and informed him of the usual remedies, namely, plowing a deep furrow to stop the onward march of the "army," if it were moving on from field to field, and destroying the caterpillars thus collected by burning with straw spread along the furrow or dragging a log of wood through it; or, if the worms were congregated in a field of grain, treating them with Paris green in order to prevent their going further. The specimens sent to me proved to be badly infested with maggots, the larvæ of a Tachina fly, and only one in consequence succeeded in reaching the chrysalis state, the rest being destroyed by their parasites. If the same proportion of worms were attacked in the fields of Amherst Island, there is not much danger of a repetition of the outbreak next year.

A few days later in the month, specimens of the same "army-worm" were brought to me from a field of grain adjoining my own garden at Port Hope. They were then fully grown and had done a great deal of damage by gnawing the soft grain in the wheat-ears. The farmer, whose crop was thus injured, informed me that the worms had crossed the road in the form of an "army" on a Sunday afternoon (where they had come from no one had observed) and at once proceeded to scatter over the wheat field and climb up

the stalks to the ears. Fortunately the grain was rapidly ripening and soon became too hard for the jaws of the caterpillar and the loss was not so serious as might have been anticipated.

About the first of August the moths began to appear and for a couple of weeks they swarmed in countless myraids. Some Tartarean honey-suckle bushes in my garden were laden with ripened berries; these attracted the moths to such an extent that the twigs were covered with them towards evening and during the night. On being disturbed by shaking the bushes, they would fly out in clouds. The moth has always been familiar to us, and is often taken by collectors when "sugaring" in the summer, but I never before saw it in such abundance.

On writing to Mr. Tighe about this time, recommending the destruction of the moths, which could be attracted by sugar or light, and enclosing specimens in order that there might be no difficulty in identifying them, he replied that the worms had disappeared shortly after his previous communication and no further damage had been done by them. They had, of course, completed their larval period and had gone into the ground to transform into chrysalids, large numbers of them then dying from the internal ravages of parasites.

In addition to the good work of the Tachina flies, which resemble the ordinary house-fly and appeared in swarms over infested fields, the worms were attacked by several species of predaceous insects, and were also devoured in large numbers by the English sparrow, which in some localities visited the army-worm districts in great flocks.

The Tussock-worm.

Another insect which attracted much attention this summer and brought out many articles and letters in the newspapers, was the Tussock-worm (*Orgyia leucostigma*), which defoliated many shade trees in the streets of Toronto. As it has been fully dealt with already by Prof. Panton in his valuable and interesting address, I need not go over the same ground again. During my occasional visits to Toronto, I have noticed this insect for several years past and have drawn the attention of friends to its injurious work on their shade trees. It ought not to be a difficult insect to control as it cannot spread with any great rapidity owing to the fact that the female is wingless and can only crawl a short distance. The cocoons are usually so conspicuous in the autumn after the leaves have fallen and during the winter, that boys could be employed to scrape them off and destroy them. A tree once cleared will remain for a long time free from any further attack. In Port Hope the insect is common enough, but has never been so abundant as to cause any appreciable injury.

The Black Potato Beetle.

At the end of June I received from the Editor of the *Mattawa Tribune*, some specimens of a beetle that was attacking the potato plant in myriads in the neighborhood of Mattawa, Ont. They proved to be the black blistering beetle (*Macrobasis unicolor*, Kirby), a species that belongs to to the same family, Meloidæ, as the "Spanish-flies," which are used for blistering purposes by the medical profession, and that possesses the same vesicating properties. The insect (Fig. 56) is long and slender, about half an inch in length,

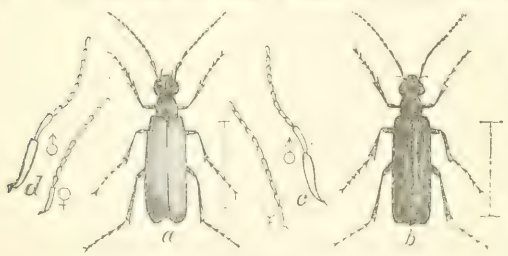


Fig. 56.

lack in colour and covered with fine whitish hairs which give it an ashen appearance; these hairs are easily rubbed off and leave the insect quite black. It is a northern species and is much more commonly found in the upper Ottawa region and on Manitoulin Island than in Southern Ontario. In the neighborhood of Montreal it has been very abundant

on Windsor, or English broad beans, and caused much damage to these plants in some gardens. While at times very destructive to these plants and to potatoes, it is unlike most injurious insects in possessing one good habit at least, and that is its practice of feeding upon the larvæ of the Colorado potato beetle. The question may therefore arise as to whether it does more good than harm. If the evidence should be adverse, then it may be dealt with precisely as its prey, and the "two birds be killed with one stone" by an aplication of Paris green in the usual manner. As far as I know, the black blistering beetle has only one brood in the year, and therefore only attacks the food-plant for a limited period, whereas the Colorado beetle has a succession of broods throughout the season, and never ceases its depredations from the time when the plants first appear above the soil in spring, till they are ready to be dug in the autumn.

Miscellaneous.

For some ten years or so the apple-tree tent-caterpillar (*Clisiocampa Americana*, Harris) (Fig. 57) has not been seen in the neighborhood of Port Hope, but this year it has put in an appearance again and I have observed a few of the moths. In Peterborough and about Toronto it has been quite numerous and destructive. Formerly it was one of the worst pests of the fruit grower that we had, and its webs were to be seen in spring and early summer on apple, pear, plum and cherry trees, and especially upon the wild varieties of the two latter. One spring, however, they were practically exterminated. The tiny caterpillars emerged from the eggs, which are laid in "bracelets" (Fig. 57, *c*) around twigs of the affected tree, at the same time as the leaf buds first opened and at once began to devour them A few days later there came a severe frost which was too much for the tender little worms and they were all killed, giving us an immunity from the pest for a number of years. Now that they have begun to appear again, it will be well for fruit growers to be on the look out next spring and to destroy every "tent" with its inmates as soon as it is discovered.

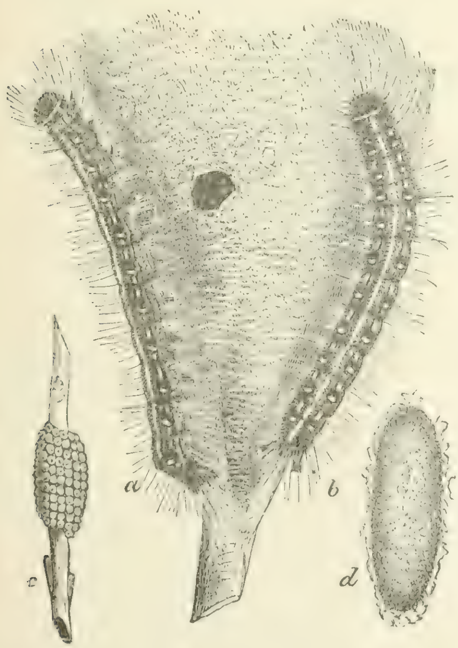


Fig. 57.

Grasshoppers, which were very numerous and did a great deal of damage to pastures, and hay and oat crops, during the two preceding years, were this season remarkably few in nnmbers and caused no appreciable injury.

Various species of plant-lice (*Aphis*) were excessively abundant and injurious to plants of all kinds during the summer; the long continued hot and dry weather being very favorable to their increase. Even such weeds as the Lamb's-quarter were covered with them and many cultivated flowers in gardens suffered severely.

The Cigar case bearer (*Coleophora Fletcherella*) was found in June upon some neglected apple trees on the edge of a field near Port Hope. This pest which has been a serious one in some localities during the last few years, is evidently spreading in Ontario and should be carefully looked for in spring and early summer. A full account of the insect and the best modes of dealing with it is given in the report for 1895 of Dr. James Fletcher, the Dominion Entomologist and Botanist.

The Fall Web Worm (*Hyphantria textor*), (Fig. 8) which has been for many years excessively abundant on ash, elm and many fruit trees, has this year been quite scarce about Port Hope, but in the neighborhood of London,—as our president Mr. Dearness relates—it has been conspicuously prevalent and many tree have been covered with immense webs. How to account for these remarkable changes in the numbers of injurious insects from scarcity or abundance in one year to the reverse in the next is one of those puzzles which may well employ the attention of the thoughtful entomologist. Sudden changes of temperature as we have seen in the case of the apple-tree tent caterpillar, very hot and very dry weather, an unusally wet and cold season, violent storms, all these no doubt have great influence in reducing the numbers or favoring the increase of some species of insects, and in addition,—perhaps most of all—the increase of the parasites that prey upon the noxious species, and the spread of infectious diseases are great factors in the problem. It can only be solved by patient daily observations of a particular species carried on from year to year by more than one investigator. This is a field of work open to all and one that may result in the acquisition of a knowledge that will be of very great scientific and practical value.

Dr. Bethune also referred to the large number of rare butterflies that had been captured this year and gave a list of their names, with localities and dates. He then read a paper by Prof. Webster, of Wooster, Ohio, who was unable to be present, on "Warning colors, protective mimicry and protective coloration."

It was then moved by W. E. Saunders, and seconded by J. A. Balkwill, that "The Entomological Society now in Session at its annual meeting, having learnt of the sympathetic statement of its work and aims made by the Hon. John Dryden, Minister of Agriculture, at the time when the grant to the Society was under the consideration of the Committee of the Ontario Legislature, desires the Secretary to convey to the Honorable Minister its sincere appreciation of his kind interest."—*Carried.*

Moved by J. A. Balkwill, seconded by W. E. Saunders, that the Secretary be requested to communicate with the Board of the Western Fair Association, requesting them to continue to offer encouragement to the Schools to make exhibits of the life-history of insects, and that their influence be used on the Fair Boards to encourage similar exhibits.—*Carried.*

Moved by D. Arnott, seconded by W. E. Saunders, that Messrs. Rennie, Balkwill and the President, be appointed a committee to meet the Board of the Young Men's Christian Association, and endeavor to make satisfactory arrangements with regard to the renting of a room for the Society, and the approaches thereto.—*Carried.*

The meeting then adjourned, after having spent much enjoyable time during the sessions on both days in exhibiting rare captures, examining the books and specimens of the Society, and comparing notes on many interesting entomological subjects.

INSECT INJURIES TO ONTARIO CROPS IN 1896.

BY JAMES FLETCHER, DOMINION ENTOMOLOGIST, OTTAWA.

There is never a season when serious loss does not occur in some part of Canada from the attacks of our numerous insect enemies. There is, however, during a succession of years great fluctuation in the amount of insect presence in any one locality. New pests develop or old ones reappear after a period of absence, and then again sometimes suddenly disappear. Day by day additions are being made to the mass of accumulated knowledge by the use of which the injuries of insects can be prevented. The importance

of the study of Practical or Economic Entomology is now widely recognized by all the civilized nations of the world. This confidence in a branch of science not taken up by many investigators is undoubtedly due to the fact that those concerned have found by experience that they are able to receive useful advice from those who have made a special study of the lives of insects, by which they are enabled to save a larger proportion of their crops than would otherwise be the case, and thus increase their incomes.

It requires many years of close study and constant observation before one can become familar with all the different attacks by insects which may demand the attention of a farmer or gardener even in a single season; but the general principles upon which remedies are applied can soon be learnt, so as to prevent foolish mistakes. A fact which must never be forgotten is that all insects have their mouth parts formed after one or other of two plans only. In one class, solid food is eaten by means of jaws, with which it is bitten off from the object attacked; in the other class, liquid food, such as the sap of plants or the blood of animals, is sucked by means of a hollow tube-like beak. It is most necessary to remember these elementary facts, because in accordance with them all active remedies are devised. For biting insects, some poisonous material is placed on their food, so that when this food is eaten by the insects they may be destroyed. For sucking insects, this method would be useless, because, having no jaws, they can feed only on liquids, for which they have to sink their sharp beak-like feeding tubes beneath the surface of the object attacked. For this class of insects, substances which will kill by simply coming in contact with their bodies must be used.

Farm crops in Ontario during the past year have not suffered from any new pests, but there has been as usual considerable loss, which might have been prevented, had the attacks been promptly reported and the proper remedial measures adopted. The three most striking infestations of the season were grasshoppers, army-worm and a local outbreak or rather increased abundance of the Tussock moth in Toronto. Under the headings of the different classes of crops, attention is called here to those which have been most frequently complained of.

Cereals. The wheat crop of the Province has been little affected by insects, and although different kinds have been mentioned by several correspondents, there has been no serious outbreak. The Wheat-stem Maggot (*Meromyza Americana*, Fitch), was conspicuously less abundant and the American frit-fly (*Oscinis variabilis*, Loew.) was not only not mentioned, but it was impossible to obtain a single specimen for examination even in localities which were badly infested in 1890

Grasshoppers were stated to be the cause of some injury to wheat, but the crops most injured by these insects were oats and hay. It is well to make special mention of the Hessian fly (*Cecidomyia destructor*, Say), fig. 58, which has been present in several places, and farmers must be prepared next year, if its injuries increase, to adopt the well known remedies of sowing their fall wheat later (about the third week in September) and burning carefully all screenings and dust from threshing machines. The Wheat Midge (*Diplosis tritici*, Kirby), fig. 59, which has been heard little of for the past six or seven years, again put in an appearance in one or two localities. This, also, will be largely controlled by the systematic burning of the rubbish from threshing machines.

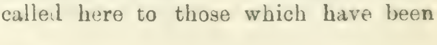


Fig. 58.

Oats have, perhaps, suffered from insects more than any other of the small grains The Grain Aphis (*Siphonophora avenæ*, Fab.) was unusually abundant in some places. Oats were also among the crops mentioned by several who wrote concerning the army-worm (*Leucania unipuncta*, Haw.) One of the most notable outbreaks of the year 1896 was by the

caterpillars of this insect. There was hardly a county in the Province where it was not reported either as a caterpilar attacking crops or as a moth which had drawn attention by its excessive numbers. This pest has been treated at length by Prof. Panton in the present report, so need not be mentioned further here, except to draw the attention of those interested to the excellent bulletin lately issued by Prof. Clarence M. Weed of the New Hampshire Agricultural Experiment Station. It is interesting to learn from this bulletin that in 1770 in the celebrated occurrence of the army worm in New Hampshire, the same remedies which we most rely on to-day, namely, trenching around fields infested and destroying the caterpillars in pits dug at intervals in the trenches were practised by the farmers of that State. As is almost invariably the case, the superabundance of the army-worm this year was much reduced by the natural enemies which always prey upon this species.

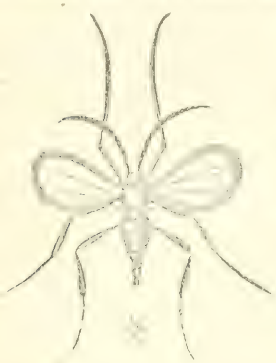


Fig. 59.

At the late meeting of the Association of Economic Entomologists held at Buffalo, N.Y., Dr. J. B. Smith stated that the army worm had appeared in New Jersey in some numbers, but only in isolated localities. In Canada, in almost every instance where invasions of this insect have been recorded, the injury has been done by a brood which appears in the larval form during the month of July and in the beginning of August; but Dr. Smith stated that it was not always the same brood which did the damage in New Jersey. The first brood seemed to be the injurious one in a southern county of the State, reports having been received as early as May. At other localities in the State injury was noted in July and as late as early in August. This is practically the same as is the case in some of our northern counties of Ontario. The most interesting record, however, is given by Mr. A. H. Kirkland, of the Massachusetts Gypsy Moth Commission, who stated that "the army-worm had been seriously injurious in many parts of Massachusetts and had damaged a large portion of the cranberry crop. He writes Sept. 3 that at Hingham, Mass., a third brood of army worms was then threatening to be as destructive as any that preceded it. He found them at that time of all stages from quite young to nearly mature." (*Entomological News*, *VII*, 1896, p. 310.)

Fodder crops. Early in the season grasshoppers of the three common species, the Red-legged locust, fig. 60, the Two striped locust, and the Lesser Migratory locust, were noticed to be remarkably abundant throughout Ontario and Quebec and in parts of Nova Scotia. These species are always somewhat prevalent, but great anxiety was felt in June last when their ravages were seen in pastures and hay fields. Clover was badly eaten in some districts early in the month and also wheat, oats and barley. Later in the summer corn, beans, turnips, and even hops were attacked. There was every appearance in July that the losses would even exceed those of 1895, but early in August it was clear that for some reason the grasshoppers were much less numerous than they had been. Several correspondents made the same report, and a few of them observed that parasites were waging an effective warfare against the locust tribes. Doubtless the sudden disappearance of these pests was due to the great increase of four of their natural enemies. One of these is a fungous disease (*Empusa grylli* [Fresenius] Nowakowski), which causes its victims to crawl up to the tops of stalks of grasses and other plants, where, grasping the stem firmly with their legs they die and their bodies become rapidly filled with a dry, mealy substance, which is really myriads of the spores of the parasitic fungus. The body of the locust soon dries up a the spores are distributed by the wind, each mummified carcass thus becoming a source infection to all other locusts which come near it. In addition to the above fungus thr other parasites—insects—were unusually abundant. One of these was a Tachina fly, fig 6 which was described as following the locusts closely and darting down, laying its white

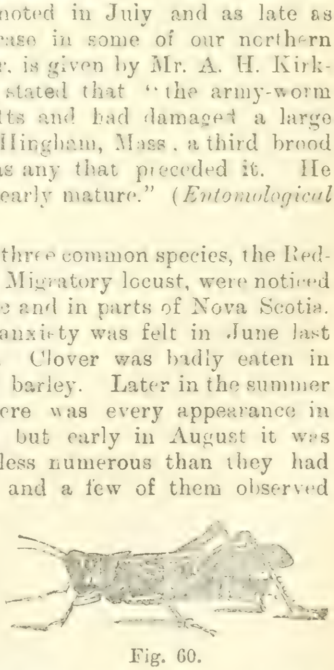


Fig. 60.

eggs on their bodies. From these eggs in a short time hatch white maggots which feed inside the bodies of their hosts until full grown, when they force their way out and, falling to the ground, which they enter a short distance, they pupate, and change to flies either the same autumn or the next spring. Prof. Riley describes graphically the operation of egg-laying by one of these Tachina flies, and much the same thing was observed by Mr. J. E. Richardson of Princeton, Ont., last July. Prof. Riley says: "The slow-flying locusts are attacked while flying, and it is quite amusing* to watch the frantic efforts which one of them haunted by a Tachina fly, will make to evade its enemy. The fly buzzes around waiting her opportunity, and, when the locust jumps or flies, darts at it and attempts to attach her egg under the wing or on the neck. The attempt frequently fails, but she perseveres until she usually accomplishes her object. With those locusts which fly readily, she has even greater difficulty; but, though the locust tacks suddenly in all directions in its efforts to avoid her, she circles close around it and generally succeeds in accomplishing her purpose, either while the locust is yet on the wing, or, more often, just as it alights from a flight or a hop." Locusts infested with these parasites are more languid than they otherwise would be: yet they seldom die until their unwelcome guests leave them of their own accord.

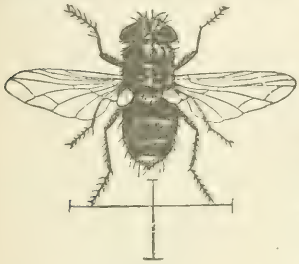


Fig. 61.

Probably the most efficient worker in keeping down the undue increase of grasshoppers is the Locust Mite (*Trombidium locustarum*, Riley), and it has been extremely prevalent and very often observed during the past summer. As it is seen attached to grasshoppers, generally at the base of the wings, it bears little resemblance to an insect and few recognize it as such the first time they examine it. The bright red swollen bag-like bodies are really the larval form of the Locust Mite, and are possessed of six weak legs, as may be discovered by examining them closely. (See figs. 62 and 63, opp. page 64). The mouth parts are very poorly developed, and, when once the mites have attached themselves to their host by means of their beak-like mouths, they remain unmoved, living on its blood until full grown. By these little parasites vast numbers of locusts are destroyed. When ready to assume the pupal condition, they detach themselves, and, falling to the ground, crawl under some shelter to complete their transformations. Gradually swelling and changing their form slightly, the mites pass through the pupal stage inside the larval skin; new legs, mouths and other organs, of a different nature to those possessed by the larvæ, are formed under the old skin, and finally this latter bursts and releases a creature very different from and much more active than the larval form. It has now eight legs and is a true *Trombidium*. The perfect mites are very conspicuous and draw attention by their velvety, bright scarlet bodies; they are frequently spoken of as "Scarlet Spiders" when sent in for identification. In this stage they are equally useful allies to the farmer as in the larval form, for while they do not attack the full grown locusts, they seek out their eggs in the ground and destroy large numbers of them. They pass the winter in the mature form and are frequently seen crawling over the ground in spring.

In May the female lays a mass of between 300 and 400 small, round, orange eggs in a cavity an inch or two beneath the surface of the ground. The young, as stated above, have six legs only and are at first exceedingly minute but very active. They crawl about until they find a locust, to which they attach themselves, mostly at the base or along the principal veins of the wings. Here they swell by degrees until their legs become almost invisible, and this is the time they are most often noticed. There has been considerable confusion as to what is the proper name of this mite. In the first place, it was not known, until Prof. Riley in 1877 worked out the life-history of this species, that the bag-like bodies with six legs only, which were so often found attached to locusts, and which were classified under an entirely different genus, *Atoma* (= *Astoma*) of Latreille, were merely the immature condition of the little red mites with eight legs which were found devouring the eggs of locusts in the ground, and when this fact was discovered there was still room for con-

* The locust might well say here, "It's fun for you but death to me."

fusion as to whether it should be called by the specific name first given to the larva when named *Atoma gryllaria* by Dr. Le Baron in 1872, or by the name of the perfect insect described in full by Dr. Riley after its true nature had been found out.

In Murray's *Aptera*, without date but bound up with Official British Museum Advertisements dated October, 1876, and presumably issued in that year, this mite is treated of under the head of *Trombidium gryllarium*; but, in Mr. Samuel Henshaw's Bibliography of American Economic Entomology, 1890,—a most valuable and carefully prepared work, which will probably be accepted as authoritative by all Economic Entomologists — *Astoma gryllarium* is made to equal *Trombidium locustarum*, and it is, therefore, well for us to adopt the latter name and to drop altogether the name *Atoma* or *Astoma gryllarium*, referring to the stage found attached to locusts merely as the larval stage of *Trombidium locustarum*, Riley.

Besides those mentioned there are many other different kinds of parasites which infest locusts, but none perhaps which excite more surprise when their strange habits are explained than the curious creatures known as "hair snakes" or "hair worms," with their slender hair-like bodies from six to twelve inches in length tapering to each end and only at most one twenty-fifth of an inch through at their greatest diameter. These may be seen sometimes crawling on or coming out of the ground in large numbers after a shower of rain, sometimes along the edges of streams, either coiled and knotted up one or many together, or singly swimming close to the surface of the water with an undulating snake like motion. Dr. Leidy, in his very valuable article on *Gordius* which appeared in the American Entomologist for 1870, when referring to the habit of these worms of coiling themselves in intricate masses, suggests that "similar knots no doubt were the source of the scientific name of the worm being applied to it by Linnæus from the fabled Gordian knot of antiquity. The *Gordius*, however, not only resembles the latter in the intricate condition into which it sometimes gets, but its history is yet in part a Gordian knot to be unravelled.'

These worms are not, by any means, unfamiliar objects in the country, and various misconceptions as to their sudden appearance in large numbers and as to their origin are widely prevalent. They are frequently sent for identification with the statement that they had fallen from the clouds in rain. The commonest error, however, is that they are horse hairs which, having fallen into water, have "come to life." It is not necessary here, of course, to point out the absurdity of this statement. "Such a transformation is an utter impossibility. No dead organic matter can thus be changed into a living creature. It is a law of nature that every animal being, from the lowest to the highest, has its commencement in an egg." (Lintner).

Several articles more or less complete have appeared on these worms. By far the fullest is the extended account in the First Report of the United States Entomological Commission, 1878, where probably nearly all that is at present known of their mysterious life history is collected together, and good illustrations are given. The hair worms,—of which there are several species, found parasitic in the bodies of insects of nearly all the different orders, such as the Orthoptera, Hymenoptera, Coleoptera, Lepidoptera and Diptera,—belong to the Entozoa or intestinal worms. They have a very remarkable cycle of development, which may be briefly summed up as follows: The eggs are laid in water, and the exceedingly minute young worms float about in a free state until they find the larvæ of some aquatic insects into the bodies of which they effect an entrance, as was observed by Dr. Meissner, a German scientist, through the delicate membrane at the joints of the legs. They then work their way gradually among the muscles and other organs throughout the body of their host and after a time become quiescent and encysted so as to resemble their former condition just before leaving the egg, and, as Dr. Meissner says, recall to mind the similarly encysted Trichinæ in the muscles of man and the hog. Mr. A. Villot added materially to our knowledge of these curious creatures and found that, when insects infested with these encysted larvæ were eaten by fish, the bladder-like cysts were dissolved by the process of digestion and the young worms set free in the intestines of their new host, at once bored by means of spines around the head into the mucous layer of the intestines of the fish, where they became again encysted. In the next stage, which

is not reached till spring, five or six months afterwards, they live a free-swimming aquatic life. To obtain their liberty, they first free themselves from their cysts in the lining of the intestines and pass into the intestinal cavity of the fish, whence they are carried out with the fæces into the water. Here remarkable changes take place. Mr. Villot says: "The numerous transverse folds of the body disappear and the worm becomes twice as long as before; its head armature disappears; the body becomes swollen, milky and pulpy. It remains immovable in the water for a variable period and then increases in size The integument grows harder and when about two inches long the worm turns brown and begins to move."

At this point in the life history of these creatures all actual observation ceases, and it is only a matter of conjecture how these parasites can find their way into the bodies of such insects as locusts, tree crickets and beetles, many of which live preferably in dry places. It has been suggested that the worms can travel long distances on foliage and other surfaces when wet with rain or dew. It must be acknowledged that there is room for much careful investigation as to the habits of these useful allies of the farmer. What is well known, however, is that they are certainly parasites which occur frequently inside the bodies of many of our injurious locusts, and during the past season were so abundant in some places—as at Ottawa—that they could be found in varying numbers from one to five, generally two or three, in almost every large-bodied locust that was examined during the months of September and October.

With the dark-colored *Gordius* worms are usually found inside the same hosts some smaller and slenderer white specimens which are very similar in general appearance; they belong to another genus (*Mermis*) differing in many respects as to structure and some stages in their life histories, but equally useful with them from their habit of living as parasites inside and ultimately destroying locusts and grasshoppers as well as other insects.

In connection with grasshoppers mention must be made of the rather serious ravages of the Gray Blister beetles (*Macrobasis unicolor*, Kirby), fig. 56. These have been abundant in some localities during the past season and have infested fields of potatoes and beans; they were also troublesome on the Siberian Pea tree (*Caragana*), now grown considerably for hedges, also on the large-leaved and ornamental Aralias, *A. spinosa* and *A Chinensis.* In the larval form these beetles are parasites in the egg pods of locusts, so that an abundant occurrence of blister beetles indicates that the armies of destructive grasshoppers are much smaller than they would have been but for this good feature in the habits of these otherwise injurious insects. The blister beetles generally appear suddenly and in large numbers, and if they are not attended to at once they quickly do much harm to a crop. Prompt spraying or dusting with Paris green are effective and where practicable great numbers may be beaten into pans containing water and coal oil. A long piece of Caragana hedge was saved in this way by giving it two beatings a day for a week in a locality where Paris green could not be obtained.

There have been other injuries to fodder crops: The Clover Root-borer (*Hylesinus trifolii*, Miller) occurred at one locality in the County of York, and the Clover-seed Midge (*Cecidomyia leguminicola*, Lintner) was rather more destructive than usual in the clover seed growing districts. Even in the eastern part of the Province its presence was clearly discernable by the appearance of the fields at the time of blooming. Reports vary as to the prevalence of the pea weevil, but, on the whole, while it seems to have been less injurious in the west, specimens have been found this year in pease grown as far east as Ottawa, which is a very rare occurrence.

Root Crops.—The root crops have been affected somewhat both by weather and insects. There has been mention of white grubs (*Lachnosterna*) Fig. 64, in potato and carrot fields, and, as mentioned above, grasshoppers and blister beetles have done their share of injury. The outbreak of most interest under this head was of the Clover Cut-worm (*Mamestra trifolii*, Esp.), which appeared during August in large numbers in the district lying around Rice Lake. The crops attacked were turnips, mangels and peas. The loss was greatest in pea fields, the leaves and even the fleshy tissues on the outside of the pods being entirely consumed. The caterpillars which vary very much in color and ornamentation first appeared about the first of August, and were in such numbers that they had to migrate

to obtain food, and for this reason were thought by some to be the army worm One correspondent wrote, "The green leaves and the vines themselves were eaten, but my peas were too nearly ripe before they were attacked to be much injured. I never before saw anything like it. The ground was literally alive with the crawling insects. We put

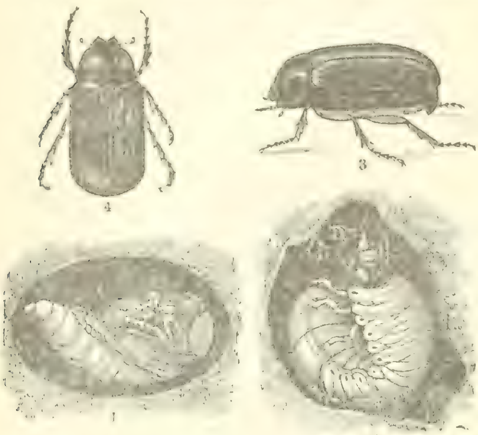


FIG. 64.

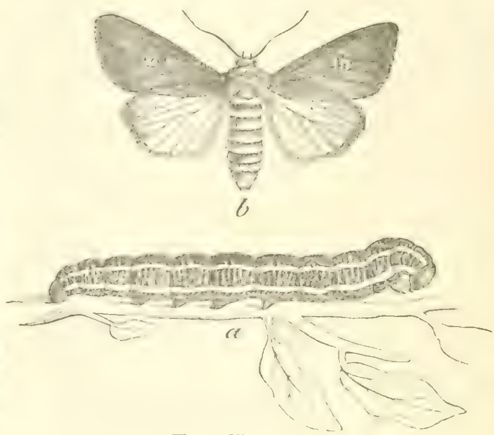


FIG. 65.

Paris green on the turnips, and this doubtless helped, but the insects were so numerous that one set after another took the place of those killed. Turnips near peas were injured most; they put forth a new set of leaves, but the growth of the roots was stunted, and they were only half a crop."

Turnips were also slightly injured by the Zebra caterpillar (*Mamestra picta*, Harris) which is a very general feeder, being found also on cabbages, potatoes, clover, celery, lucerne and many other plants. The caterpillar is a most showy insect (Fig. 65*a*); when full grown nearly two inches in length, velvety black on the back with the sides gaily ornamented with golden yellow lines connected by wavy white threads; the head and feet are chestnut red. When ready to transform the caterpillar spins a loose cocoon of silk with earth mixed with it and changes to a black chrysalis. The moth (Fig. 65*b*) has glossy brown upper wings and the lower ones are whitish. The eggs are laid in large clusters beneath leaves and seem to be, at Ottawa at any rate, much more infested with egg

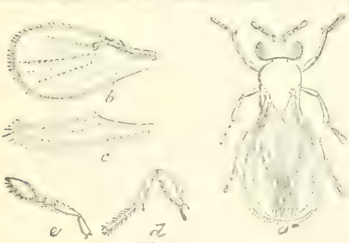


Fig. 66.

parasites than those of almost any other insect In September, 1892, I found upon a plot of Bokhara clover (*Melilotus alba*, Lam.) hundreds of clusters of the eggs of this moth, which were so much parasitised by two minute hymenopterous insects, *Trichogramma pretiosa*, (Fig. 66), and a new species of *Telonomnus*, that not one per cent. of the eggs gave caterpillars. The only remedies which can be applied for the Zebra caterpillar are arsenical mixtures, and this species seems to be particularly resistent to the effects of all poisons so far experimented with. There are two broods in the year, the latter of which may be noticed on fine days long after the first severe frosts.

VEGETABLES.—In gardens the regular yearly pests such as cut worms, turnip flea, Colorado potato beetle, and the cabbage caterpillars have required attention. The species of cut-worm whose injuries have been most conspicuous, has again this year been the red-back cut-worm (*Carneades ochrogaster*, Gn.) This is a large and widely distributed species which feeds upon almost every kind of succulent vegetation. It was particularly destructive to newly set cabbages and tomatoes and to young beet root, as well as many annuals in the flower garden. Careful trial was made this year of the poisoned bran remedy, and good results were obtained. Bran or oat-meal was moistened with sugar in water sufficiently to allow of being ladled out with a spoon. Into this sufficient Paris green was

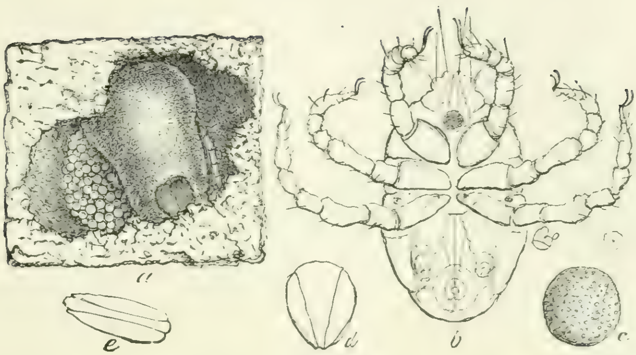


FIG. 62.—TROMBIDIUM LOCUSTARUM.—*a*, female with her batch of eggs; *b*, newly hatched larva—natural size indicated by the dot within the circle on the right; *c*, egg; *d*, *e*, vacated egg-shells (after Riley).

FIG. 63.—TROMBIDIUM LOCUSTARUM.—*a*, mature larva when about to leave the wing of a locust; *b*, pupa; *c*, male adult when just from the pupa; *d*, female—the natural sizes indicated to the right; *e*, palpal claw and thumb; *f*, pedal claws; *g*, one of the barbed hairs; *h*, the striations on the larval skin (after Riley).

(*See page 61.*)

Phelps Lake in Illinois, August, 1894. Dead Fish and Mussels. (After Forbes.)

Phelps Lake, August, 1895. After being brought under cultivation. Corn and Pumpkins. (After Forbes.)

(*See page 84.*)

stirred to give it a decidedly green tinge. A spoonful of this mixture was placed at intervals of six or eight feet along rows of peas, beets and carrots, which were being rapidly destroyed by these cut-worms. The results were most satisfactory, the poisoned bran was apparently so attractive to the caterpiliars that only two or three plants were afterwards cut off and the bran was eaten instead, many caterpillars being found dead near the bran but some distance under the surface of the soil, where they required to be looked for with some care.

The "Black Army-worm" (*Noctua fennica*, Tausch) was abundant in the neighborhood of Picton, Ont., where it did much harm to peas and other garden plants, including raspberries and other small fruit.

Squashes and cucumbers have been much injured in western Ontario by the striped cucumber beetle (*Diabrotica vittata*, Fab.), and the true squash bug (*Anasa tristis*, De Geer) Fig. 67, was reported as very troublesome at Hamilton. When the plants are young and small, probably the best remedy is to cover the hills with a square of mosquito netting, or cheese cloth, supported by two or three sticks stuck in the ground and with the edges held down with a few handfuls of earth. When the plants get too large to be so confined, the insects may be kept away to a measure by sprinkling over the hills ashes or land plaster with which coal-oil has been mixed. Hand-picking for the Squash Bug must also be resorted to; for this purpose shingles are placed near the plants for the bugs to hide under.

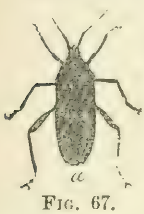


FIG. 67.

FRUITS.—Fruit insects in Ontario have been decidedly less noticed during the past season than for many years previous. This is probably due to the enormous crop which has been reaped; timely rains and fair weather for fruit crops seem to have prevailed over the whole Province. As in the past those who sprayed carefully, obtained paying returns. Although, on the whole, insect enemies have demanded less attention than usual, it is feared that carelessness in orchard management by which defective and infested fruit was left unpicked from the trees or to rot on the ground, may be followed next year by a large increase in the number of injurious insects which will in all probability infest a much smaller crop over the whole Province.

In western Ontario the second brood of the codling moth was particularly destructive. The work of the plum curculio, owing to the enormous crop of plums, was not so manifest as usual, but where looked for, could usually be found, In some districts where plums are not much grown, this is by far the worst enemy of the apple crop. The apple curculio (*Anthonomus quadrigibbus*, Say.) is not a very frequent enemy of the apple in Canada, seeming to confine its attacks more particularly to the fruit of the hawthorn. Two new attacks upon apples of considerable interest to fruit growers have to be recorded. The first of these by the caterpillar of a small moth which has not yet been bred to maturity, has affected to an appreciable degree the apple crop of certain localities in British Columbia, and what may possibly be the same insect has been found in a few instances at Ottawa and Montreal, but the injury to the fruit was much less serious than in the British Columbian apples, where the caterpillars burrowed in every direction through the flesh of the apple, causing it to decay and entirely destroying it for the market. The outside of the fruit was also gnarled with sunken depressions where the caterpillars had entered, and in many instances, this spot was marked with a white deposit similar to birds' droppings. This latter fact, however, is comparatively of small consequence, because the fruit bearing these deposits is already destroyed by the discolored burrows of the caterpillars which run in every direction through the fruit for which reason the name of "apple fruit-miner" is suggested. Judging from the nature of the injury to the apples this season, this is certainly a much more serious enemy than the larva of the codling moth, and the condition of an infested apple is much more nearly like that produced by the apple maggot (*Trypeta pomonella*, Walsh) for which indeed it was mistaken by some observers, but from which it is entirely distinct. The second attack new to this country, is by the true "Apple Maggot" which this year for the first time on record has infested cultivated apples in Canada in the orchard of Dr. D. Young, a careful observer of insect habits, living at Adolphustown, Ont.

At the end of October Dr. Young sent me some apples containing a few larvæ and showing undoubtedly the work of this injurious insect which he had never found in his orchard before this season. Three or four varieties only of apples were infested. It is important to notify fruit growers as soon as possible of the occurrence of this insect in our orchards as an apple pest and to give from the experience of growers in the New England States the measures which have been found most successful in fighting against it. The insect was first described by Walsh in his first report as State Entomologist of Illinois in 1868; but it had been known in the eastern states for several years before that, having attracted attention by its serious injuries to the cultivated apples in New York, Massachusetts, Connecticut and Vermont. Strange to say, although it has never, as far as I can learn, attacked cultivated apples in Canada until this year, it is common in collections of insects and occurs abundantly in the fruit of hawthorn in many localities. In 1887 I bred the fly from haws found at London, Hamilton, Toronto, Montreal and Ottawa. In 1888 the fruit of the hawthorn bushes on the Experimental Farm was so much infested by the maggot of this fly and the grub of the apple curculio that it was almost impossible to find a sound fruit. It is, however, by no means a singular habit for an insect to confine itself to a certain food plant in one locality when others are growing close to it, which elsewhere are preferred by the same species.

The most important articles on this subject have been written by Walsh (Ill. Rep. I.), Comstock (Rep. U. S. Comm. Agric., 1881-2), and particularly Prof. Harvey, who wrote a long and complete account in the annual report of the Maine Agricultural Experiment Station for 1889, where the full life history of the species is for the first time detailed. The life of this insect may be said to be as follows: The perfect flies begin to emerge about the first of July and continue to appear until about the middle of September; eggs are laid at once, those first deposited producing the earliest flies the following season. The egg is forced through the skin of forming apples by means of the horny ovipositor of the females. The maggots hatch and run tunnels all through the fruit of the apple leaving discolored brown tracks wherever they go. In this way the fruit is rendered quite unsaleable and ripens prematurely. The maggots are full grown in about five or six weeks, and as soon as the fruit falls they leave it and entering the ground a short way turn to puparia and in that condition pass the winter. Early and sub acid varieties of apples seem to be preferred, but late and winter varieties are also attacked. When the late varieties are infested, the maggots do not emerge until sometime during the winter after the fruit has been stored. In all Prof. Harvey's investigations he never saw an apple hanging on the tree from which the maggots had emerged. This is an important point because it shows the value of collecting all fallen fruit as soon as possible after it falls and destroying it so that the maggots may not leave and go into the ground to pupate. There are different ways by which this may be done. They may be collected by children and fed to stock, or, if there is no stock to eat them, they may be buried in a deep hole and afterwards covered up so that the flies may not be able to emerge the following season. Sheep or swine kept in the orchard from about the 15th July would save much labor by eating the fruit as soon as it fell to the ground, and poultry would render good service by devouring the fruit, maggots and puparia beneath the trees. The larvæ do not penetrate more than an inch or an inch and a half beneath the surface, so would easily be scratched out and found by chickens. Prof. Harvey draws attention to some important facts in the habits of the apple maggots. He points out that the perfect insects are rather sluggish and that the species does not seem to spread very rapidly in a new locality from orchard to orchard nor even from tree to tree in an orchard. He shows clearly, however, that it is a most serious pest from the way in which infested fruit is rendered quite useless for human food. The females are very prolific, each one laying from 300 to 400 eggs, and the young maggots hatching inside the apples are inaccessible to any wholesale method of treatment such as spraying. Up to the present no parasites have been detected feeding on the insect. Almost all varieties of apples are liable to attack and as many as a dozen maggots have been found in a single fruit. Under remedies, he says, "The only chances are to destroy the larvæ and pupæ. The larvæ are found abundantly in windfalls, and the pupæ in bins and barrels where fruit has been stored. Destroying wind-

falls would prevent the maggots going into the ground, and burning refuse from bins and barrels would dispose of those in stored fruit. These methods are practical, easily applied and should be rigidly enforced." "There is no lazy way to check this insect. It will have to be done by a direct, squarely-fought battle. We firmly believe we have in the careful destruction of the windfalls the means of destroying the pest."

The Cigar Case-bearer (*Coleophora Fletcherella*, Fernald) has been decidedly less abundant this season than for three or four years previously. Good results from spraying are reported by Mr. Harold Jones of Maitland, Ont., who noticed the young caterpillars moving on the bark on May 2 and at once sprayed with kerosene emulsion and practically cleared his orchard. Mr. W. H. Little, of Trenton, Ont., says it has been numerous in his orchard for about four years, but has kept it within control by spraying with Bordeaux mixture and Paris green. The insect is reported from Goderich and Port Hope in restricted localities. It was found at the latter place by Dr. Bethune in numbers upon an isolated apple tree against a fence, a long way from any orchard or garden. At Port Hope some specimens of a small parasite were bred from the cases by Mr. Wm. Metcalfe. These have been identified by Mr. W. H. Ashmead as *Microdus laticinctus*, Ash.

The Pear Slug (*Selandria cerasi*, Peck), this old enemy of the fruit grower, seems to have been unusually abundant during the past summer in all parts of the Dominion where prunus fruits are grown. Mr. L. A. Woolverton states that the second brood is more troublesome than the first and suggests that the reason is because at the time of the year when it appears, fruit growers are so busy picking and marketing fruit that it is almost impossible to find time to spray with Paris green.

After the exceptionally heavy crop of all fruits throughout the province this year, it is almost certain that the next season's crop will be light; the careful grower who attends to all such *little* matters as spraying will then most certainly reap a rich harvest at the expense of his less thoughtful neighbours. It is in the off years that the skill of the horticulturist is called forth; he cannot, it is true, always make his fruit trees set fruit and bear, but he can in many instances by skilful management materially improve the quality of his crop, and it is in years when the crop is small that he has the greatest latitude to show his superiority over the easy-going grower who trusts to luck and lets things come as they may.

Fig. 68.

Grapes have suffered somewhat from the Phylloxera. Mr. Woolverton found the leaf gall inhabiting form unusually abundant throughout the Grimsby district. In many cases hundreds of vines on a plantation had their foliage covered with the galls of the louse—Fig. 68. In the September number of the *Canadian Horticulturist* appeared a figure of a branch of a grape vine infected by Phylloxera. There are few insects as well known as the notorious *Phylloxera vastatrix*, Planchon, which has been the cause of such enormous losses to the grape growers of France, Italy, Spain, and other countries in Europe. This pernicious insect is a native of America, whence it was introduced into Europe and where it now commits terrible ravages, far exceeding anything that has ever been recorded here in its native country. The life-history was worked out by the late Dr. C. V. Riley and has appeared in several of our previous reports. There are two forms of this insect with very different habits. The first produces greenish red or yellow galls on the foliage, as shown in the illustration kindly lent by the editor of the *Canadian Horticulturist*; the other, which is the most injurious, attacks the roots, causing swellings on the young rootlets, which

finally decay and thus the root system of the vine is destroyed. The winter is passed in a dormant condition on the roots. In spring there are five or six generations of wingless females, all of which bear young without the intervention of males. In July some winged females are produced which leave the roots and fly to other vines, when each one lays a few eggs of two different sizes, from which are produced in about a fortnight perfect males and females. These are born for no other purpose than reproduction and are without means of flight or of taking food. Each female lays one egg, from which comes an egg-bearing, wingless female, thus beginning a new circle of existence. The winged females which are first seen in July continue to appear throughout the season and are most abundant in August.

Occasionally the underground form leaves the roots and produces galls on the leaves. These are more abundant in some seasons than in others, as during the past summer—but the Grape Phylloxera cannot from past experience be considered a serious pest in Canada, although at rare intervals there has been a loss of many vines in some vineyards which have been badly infested. The only remedy which has been adopted in this country has been the destruction of badly infested vines or the removal of gall-bearing leaves from those which are less severely attacked.

Another insect which has been locally troublesome on grape vines in western Ontario is the Grape Thrip (*Erythroneura vitis*, auct.). Mr. Woolverton thinks that it is increasing steadily year by year. It has been treated effectively by spraying vines carefully with kerosene emulsion before the young of the first brood acquire their wings.

The two broods of the Strawberry Leaf-roller (*Phoxopteris comptana*, Frol.) Fig. 69, did considerable injury to strawberry beds around Picton, Prince Edward County, in June last and in the antumn. Luckily for Canadian growers of small fruits it is a rather rare occurence for this insect to be sufficiently abundant to attract notice, but in some of the northern United States it is considered the most destructive of the enemies of the strawberry grower. The caterpillars were found on the strawberry plants towards the end of June and were not noticed until they had injured one field of four acres sufficiently to give the plants the appearance of being attacked by a severe blight or as if fire had been over them. The caterpillars when full grown are about one-third of an inch long and vary in colour from yellowish-brown to dark-brown or green. They fold the leaves of the strawberry by drawing the upper surfaces together and fastening them with strands of silk. They then eat away all the green inner surface of the leaves, giving the beds a brown and seared appearance.

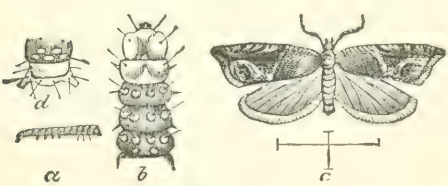


Fig. 69.

Mr. John Craig, of the Central Experimental Farm, who visited some of the Picton plantations on the 4th of July last, found that many of the caterpillars were full grown and ready to pupate; others, however, were small and would not turn to chrysalids for certainly a week or two later. Moths emerged at Ottawa from infested leaves sent from Picton between July 15 and 25, a period which would probably be extended at any rate till the end of the month in the fields. Eggs laid by this brood of moths produced caterpillars which again attacked strawberry beds severely at Picton in the autumn. As a remedy for this insect it has been recommended to mow off and burn the leaves of infested beds directly after the fruit is picked. The leaves containing the caterpillars or chrysalids, would soon dry up and would burn easily. That cutting off the leaves at this season can be done without injury to the plants has been proved by Mr. Craig in some experiments for controlling the strawberry rust. (See *Experimental Farm Report*, 1895, p. 113). It must be done of course before the moths begin to emerge. The second brood can be treated much more easily. When beds are known to have been infested by the spring brood, the plants must be sprayed or dusted with Paris green during August, so that the young caterpillars may be destroyed as soon as they hatch. Should the injuries be noticed only late in the season when the caterpillars are well grown, burning the foli-

age may again be resorted to. The occurence of this insect at Picton was mentioned in the *Canadian Horticulturist* for July last in a letter by Mr. Craig and the remedy of burning the foliage recommended.

Red Spiders (*Tetranychus*, sp.) Fig 70, have been abundant and very destructive in many places particularly during the hot weather in August. There are doubtless many species of mites included under the general head "Red Spider." These minute plant-feeding mites are extremely difficult to control—when the weather is dry and hot. Frequent waterings with a hose where possible have a good effect, and sweet peas in several gardens at Ottawa were saved in this way. Dusting with sulphur also had a marked influence on the mites. Kerosene emulsion applied early to plants known to be infested was perhaps the most fatal remedy, but in large fruit gardens upon black currants and raspberries severe injury was done both by the mites and the frequent applications of the emulsion to the enfeebled foliage. As yet it must be acknowledged no practical remedy has been discovered for these pests when they are abundant and during hot, dry summers.

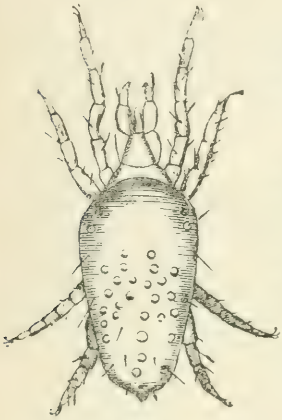


Fig. 70.

The Black Peach Aphis (*Aphis persicæ niger*, E. F. Smith), appeared last year for the first time in Essex County. This year there has been no complaint from that locality; but I fear that peach-growers from not recognizing the danger of this insect are failing to report its presence. Another occurrence was discovered near St. Catharines in a newly set peach orchard. The owner of the orchard, on having his attention drawn to it, promptly rooted up the trees and destroyed them.

SOME BEETLES OCCURRING UPON BEECH.

By W. Hague Harrington, F.R.C.S., Ottawa.

When so many of our forest, shade and orchard trees are defoliated and disfigured by an endless succession of insect pests it is satisfactory to find one of our most beautiful and valuable species comparatively free from such attacks. At the close of summer the stalwart, handsome beech will be found with its raiment of bright, glossy foliage almost as fresh and unspotted as in springtime, while its neighbours, the maples, elms, etc., are more or less naked and threadbare. Yet, favored as it is, there are several species of moths whose caterpillars find the tough leaves not unpalatable, such as *Hyperetis nyssaria*, A. & S., whose larva was described by Prof. Saunders in the Canadian Entomologist, vol. iii., p. 209, and the pretty little casemaker, *Incurvaria acerifoliella*, Fitch, which at times so seriously infests the maples. (See Trans.-Ottawa Field Naturalists' Club, No. vi., p. 353.) The trunk when injured, or when the trees become weakened by age, is riddled by the boring larvæ of the large Horntail, *Tremex columba*, Linn, one of the most striking of our Hymenoptera, and becomes gradually the feeding ground of a variety of insects. The majority of the insects, however, which I have found infesting this tree belong to the order Coleoptera, and while but few of the species do serious injury to the tree when it is still vigorous, it may not be uninteresting to make a brief record of the species which have been noted by myself, or which have been recorded by Dr. Packard in his Forest Insects (Fifth Report of the United States Entomological Commission, pp. 513-520.)

TROGOSITIDÆ.

1. *Trogosita corticalis*, Melsh. An elongated, flattened, brownish beetle, about three-fifths of an inch long, with finely striated elytra, found under the bark of old trees; cannot be considered injurious.

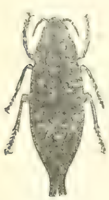
2. *Grynocharis 4-lineata*, Melsh. A more flattened black beetle, about twice as wide as long, and very variable in size, from a little over two tenths to nearly four-tenths of an inch long. Each elytron has four raised lines, between each pair of which is a double row of punctures. This beetle is found under bark with preceding, and is also harmless.

ELATERIDÆ.

3. *Corymbites cruciatus*, Linn. A handsome "click-beetle," whose larva is one of the wire worms which feed in decaying wood, and which has always been found by me on, or in the vicinity of, beech. It is about half an inch long, head black with the exception of the reddish mouth parts, thorax black with a bright red stripe down each side above and below, body beneath black margined with red, elytra yellow with sutural stripe, short humeral stripe and sinuate band behind middle, black. The black sutural stripe and the transverse band form the cross from which the name is derived.

BUPRESTIDÆ.

4. *Dicerca divaricata*, Say. A brownish or blackish bronzy beetle, of rather stout build, from three-quarters to almost an inch long. (Fig. 71.) It is a well known pest of such trees as the maple, apple, etc., its larvæ being one of the "flat-headed" borers, so-called because the thoracic segments (next the head) are much wider than those that follow. It is sometimes quite abundant on old trees, and in May and June can be found ovipositing therein. Some entomologists consider that the beech was the original food-plant of the insect.



F 71.

FIG. 72.

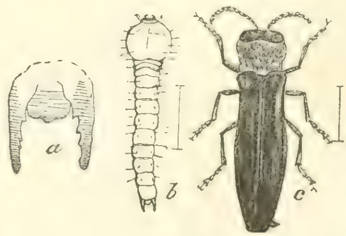


FIG. 73.

5. *Chrysobothris femorata*, Fab. This common borer of the apple tree (Fig. 72) has also been recorded (Riley, 7th Rept., p. 72) from beech, although of all the forest trees in this neighbourhood it seems to prefer the hickory. The oak, maple, mountain ash, linden and box elder are also said to be attacked by it. It is a flattened beetle, somewhat over half an inch long, of a metallic, bronzy colour with some greenish reflections, and the face of the male is bright green. It has been often mentioned in our Reports.

6. *Chrysobothris sexsignata*, Say. This beetle very closely resembles the preceding, but is slightly smaller, and is more rare with us. Mr. Chittenden records (Ent. Amer. V., p. 219) cutting a specimen from a beech tree. This beetle has also been found in yellow birch (Packard l. c., p. 485

7. *Agrilus bilineatus*, Web. This pretty little beetle is more elongated and in shape strongly resesembles the Red-necked Agrilus *(A. ruficollis)* (Fig. 73) which forms the gouty swellings on raspberry canes (Fig 74). It is about three-tenths of an inch long, and the upper surface is black, or greenish black, with a line of golden pubescence on each elytron, and on the margin of the thorax (these lines sometimes rubbed off or wanting); below the colour is coppery. I have taken it upon beech and believe it to infest this tree. Dr. Packard and Prof. Riley have each found it infesting oak.

Fig. 74.

8. *Agrilus interruptus*, Lec. This species much resembles the preceding, but is somewhat smaller and more slender. Its colour is more of a bronze, and instead of the line of pubescence it has a minute golden dot toward the tip of each elytron. I have found it upon beech, birch and hickory, but do not find in my books any records of the trees upon which other collectors have found it.

9. *Brachys æruginosa*, Gory. The larvæ of this little buprestid have been found by Mr. V. T. Chambers (Packard. l. c., p. 519) to mine in the leaves of the beech. The posterior segments are not so tapering as in the larvæ of the species previously mentioned. The beetle very closely resembles the following in size and appearance.

10. *Brachys aerosa*, Melsh. (*B. terminans*, Lap) is rather a common beetle with us, and is found most frequently upon the basswood, but also occurs upon elm, beech, etc, and may mine in the leaves of all these trees. It has been bred by Prof. Gillette from the leaves of poplar (Can. Ent., vol. xix., p. 138). The beetle is only about one-sixth of an inch long, of a sub-triangular or narrow shield-shaped figure; general colour coppery, the elytra purplish and ornamented with pubescence, which forms a band across the tips. We have a larger species, *B. ovata*, Web., which occurs upon oak.

Cleridæ.

11. *Thanoclerus sanguineus*, Say. This little beetle is sometimes abundant under the bark, and quickly attracts attention by its bright red colour. It is one-fifth of an inch long and quite narrow; the head and thorax a duller red than the elytra and legs. It is very active in its movements, and when disturbed quickly hides in a crevice or the burrow of some borer. It is rather beneficial than injurious to the trees upon which it occurs, as it preys upon other insects.

Ptinidæ.

12. *Eucrada humeralis*, Melsh. I have found this beetle under the bark of beech, and as most of the members of this family are destructive insects this may probably be classed as such. It is about one-fifth of an inch long, of brownish colour, with a reddish spot on each shoulder of the elytra which have several rows of punctures.

13. *Ptilinus ruficornis*, Say. This small cylindrical beetle which is very frequently found boring "pin-holes" in oak and maple, has also been found by me to do the same in old beech trees. The female is one-tenth of an inch long, brownish, with the head bent down under the globose thorax, the elytra faintly punctured. The male is only about half as large and is easily recognized by his prominent red antennæ (which give the species it name), the outer joints of which have long leaf-like projections.

LUCANIDÆ.


FIG. 75

14. *Platycerus quercus*, Web. This beetle and the two following belong to the stag-beetle family, in the males of which the mandibles, or jaws, are sometimes wonderfully developed. In this species they are as long as the head and turned up and irregularly toothed at the point (Fig. 75.) The beetle is about half an inch long, rather flattened, bronzy black in colour, shiny and feebly punctured. The female is lighter in colour, being nearly brown above; the legs and under surface reddish. The larvæ like those of the following species live in decaying wood of various trees.

15. *Platycerus depressus*. Lec. This species differs from the foregoing in being slightly larger, blacker and with the elytra more coarsely striate and punctured. The mandibles are shorter and stouter.

16. *Ceruchus piceus*, Web. This is a very common insect in old beech logs and stumps. It is much more stoutly built, and is very variable in size; from two-fifths to three-fifths of an inch long, the males being much larger than the females. The head is large, as wide as the thorax, and with a deep frontal depression. The jaws of the male are as long as the head, and with a strong inner tooth about the middle.

SCARABÆIDÆ.

17. *Dichelonycha elongata*, Fab.—A rather cylindrical beetle; four-tenths of an inch long; the general colour testaceous or yellowish; head flattened above; thorax more or less pubescent; wing covers with a greenish reflection, more pronounced in the males; under surface hoary, with scale-like hairs; tips of hinder legs sometimes blackish. This beetle and two or three closely allied species difficult to separate from it, feed in the perfect state, on a variety of trees. They much resemble in size and general appearance the Rose beetle, *Macrodactylus subspinosus*, Fab., which belongs to the same family but is, however, smaller and less corpulent. I have found them not infrequent on beech.

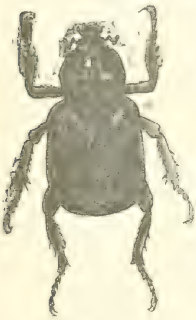


Fig. 76.

18. *Osmoderma scabra*, Beauv.—This is a large stout beetle (Fig. 76) of a dark bronze, or metallic-brownish colour. Its length is nearly an inch, and it is about half as wide (across the elytra). The head is small, squarish and depressed above; the thorax rounded and irregularly punctured; the elytra irregularly wrinkled and striated. When alive this beetle diffuses a strong odour, which much resembles that given off by Russian leather. The larvæ feed in the decaying wood of old trees, and are fat white grubs much like those of the May-beetles. They construct large oblong cocoons from the particles of decayed wood, in which the grub pupates and finally becomes a beetle. It is probable that the closely allied species *O. eremicola*, Knoch., also breeds in old beech cavities.

SPONDYLIDÆ.

19. *Parandra brunnea*, Fab.—The shape of this beetle and its large mandibles give it a great resemblance to some members of the Lucanidæ (Stag-beetle family), but it is at once distinguished by having the antennæ straight and tapering to the tip, instead of terminating in a leafed club. It is variable in size, from five-tenths to eight-tenths of an inch in length, and of an almost uniform reddish or yellowish brown colour. The grubs live in the wood of stumps and old trunks of various trees, the beetles being found under the loose bark, although they are seldom numerous.

CERAMBYCIDÆ.

20. *Smodicum cucujiforme*, Say.—This beetle I have not seen, but it is one of the smaller species of the longicorns, being only three-tenths of an inch long. The following is part of the original description of the species: "Body depressed; head with a slight

rufous tinge, antennæ rather shorter than the body, tinged with rufous; thorax longer than broad, obtusely contracted each side, rather before the middle; elytra irregularly punctured, without elevated lines; thighs dilated." Mr. Schwarz records finding it under the bark of beech. (Packard l. c. p. 79).

21. *Dryobius sexfasciata*, Say.—Mr. C. G. Siewers records (Can. Ent. vol. XII., p. 139) finding five examples of this handsome beetle under the bark of beech. The grub is stated by Dr. Fitch to be much like that of the common elm-borer, *Saperda tridentata*, Oliv., but larger. The beetle is also of nearly similar form to that species, the length about three-quarters of an inch; colour black, and each elytron with four oblique yellow bands.

22. *Xylotrechus quadrimaculatus*, Hald.—This beetle much resembles in shape and colour a longicorn, *Neoclytus erythrocephalus*, Fab., which is often found on hickory. That species, however, is smaller, and has longer legs; the yellow markings are also different. *X. quadrimaculatus* is half an inch long, and of a reddish colour; head small; thorax globose with two bright yellow spots on front margin and less distinct markings on the hinder margin; elytra with somewhat yellowish tinge and faint oblique yellow lines; legs slender and pale reddish. The only specimen of this beetle which I have taken at Ottawa was found resting on the branch of a beech in June.

23. *Cyrtophorus verrucosus*, Oliv.—This is a common beetle, very ant like in appearance, which occurs upon various trees, and very frequently upon flowers, such as spiræa, goldenrods, etc. Mr. Chittenden has bred examples from beechwood. It varies considerably in size, but average examples are four-tenths of an inch in length. The head is small and sunken to the eyes in the thorax; the antennæ are nearly as long as the body and very slender, the third joint having a strong spine at the tip. Thorax rounded and humped above, very closely and finely sculptured. The elytra are angulated at the shoulders, and each has an elevation near the base, along which runs diagonally a narrow white line, behind which are two less oblique lines, the last being almost transverse. Sometimes the beetle is all black, with the exception of these white lines, and the partly reddish legs, but many specimens have the basal half of elytra (between the thorax and transverse white line) reddish, as also the corresponding under surface and the legs.

24. *Centrodera decolorata*, Harr.—This is a much larger longicorn of which I have taken one example on beech. It is about an inch long, of a chestnut red colour, except the elytra and abdomen, which have a more yellowish tinge. Head moderate in size, and narrowed behind the large, coarsely granulated eyes into a neck. Thorax small, narrowed in front and strongly angulated, or subspinose, in the middle. Elytra at base nearly twice as wide as thorax, and tapering very little toward the rounded tips; coarsely punctured at base, and more finely toward tips, Antennæ reaching to middle of elytra, dusky except basal joint. Legs moderately long and stout.

25. *Toxotus Schaumii*, Lec.—A very handsome longicorn of which one of my examples was taken on a small beech, in a beech grove, in July. It much resembles in size and shape the preceding species, but the thorax is less strongly angulated, and the elytra taper more. With the exception of a wide red band on all the thighs it is entirely black.

26. *Anthophilax attenuatus*, Hald.—One example of this rare longicorn was taken by me in an old beech log in May. It is in general shape much like the foregoing and about three-quarters of an inch long. Head and thorax black; antennæ and legs slender and reddish; elytra brownish and mottled with whitish pubescence.

27. *Leptura subhamata*, Rand.—An example of this pretty and variable species was also taken in an old beech log, and I have taken it likewise on oak. It averages about half an inch in length, and is of rather slender build. The head is small and narrowed to a neck; antennæ long and slender, the joints partly yellow at base. In the male the thorax is black, but in the female it may be either black with a yellowish side stripe, or yellowish with a black central stripe. The elytra of the male are black, with a yellow

stripe on each reaching from the shoulder to beyond the middle, and crossed by a black band so as to form a cross. In the female they may have the same pattern, only the yellowish stripes are larger, or the elytra may be yellowish with a narrow black rim and a band across the middle. Under surface of male, and most of legs, black; under surface of female and legs mostly yellowish.

28. *Goes pulverulentus*, Hald.—This beetle has been recorded by Dr. Horn as very destructive to living beech trees, in the larger branches of which it bores tunnels several inches in length. It may, therefore, be considered one of the most injurious insects infesting this tree, and, as I have previously recorded (Ann. Rept., xiv p. 48), there is little doubt that it also inhabits the hickory. It is a rather large beetle, and in shape closely resembling the female of the common pine-borer, *Monohammus confusor*, Kirby, the smaller specimens of which it equals in size. Length from three-quarters of an inch to about an inch; antennæ slender and slightly longer than body; thorax cylindrical, with a sharp spine on each side; elytra wider than thorax; legs moderately long and stout; colour brownish, but having a hoary appearance, especially beneath, from short white pubescence.

29. *Acanthoderes quadrigibbus*, Say.—This species has been recorded by Mr. Schwarz as boring in the dry twigs of beech and oak. It is a pretty little beetle, quite different in shape from the preceding. Its length is about three-fifths of an inch, and it is rather broad and flattened in proportion to its length; thorax tuberculate above; legs short; the thighs rather stout; elytra with mottled whitish and brownish pubescence and with a sinuate whitish band before the middle.

30. *Leptostylus macula*, Say.—This species which infests the butternut and chestnut has also been observed by Mr. Chittenden to inhabit the beech. I have found it upon butternut, maple and balm-of-gilead, but more frequently upon hickory. It does not differ very greatly in appearance from the preceding beetle, but is smaller and less tuberculate. Individuals vary in length from one-fifth to three-eighths of an inch, colour brownish; thorax with a white stripe on each side, bordered above by an interrupted brown line; legs banded with white and brown; elytra coarsely punctured and imaculate with brown spots, and banded with white behind the middle; antennæ long and slender.

31. *Hoplosia nubila*, Lec.—This species, according to Mr. Schwarz, also bores in the twigs of beech. It is longer and narrower than the preceding insect. Length three-eighths to one-half of an inch; thorax with lateral spines; antennæ longer than body and slender; elytra longer and almost parallel sided, truncate at tips instead of rounded: colour brown, with mottling of whitish pubescence, giving a spotted appearance, and leaving irregular bands on the elytra.

RHIPIPHORIDÆ.

32. *Pelecotoma flavipes*, Melsh.—A small, slender beetle which on one occasion I found quite abundantly on an old beech tree. As the members of this family are parasitic in their habits, it may probably be considered as a beneficial species, preying perhaps, upon some of the inhabitants of the tree.

OTIORHYNCHIDÆ.

33. *Pandeletegus hilaris*, Hbst.—This beetle belongs to a family of weevils, or snout-beetles, which contains some well-known injurious insects. Harris records it as boring in oak, and occurring on all trees from May to September; while Mr. Chittenden notes it as common upon the beech. I have not found it at Ottawa yet, but have received specimens from Mr. Johnston, of Hamilton. It is quite small, being only from one-eighth to one-fifth of an inch long; colour pale-brown, with some greyish and black stripes; beak short and broad; thorax coarsely granulose; elytra with rows of deep punctures.

CURCULIONIDÆ.

34. *Ithycerus noveboracensis*, Forst.—This species is the largest representative of the family which occurs with us. It has been found at times a serious pest in orchards, injuring apple, peach, pear, plum and cherry (see Insects Injurious to Fruits, Saunders, p. 196.) According to Riley it infests the oak, in the twigs of which the larva tunnels. With us it seems to inhabit the beech, upon which I have frequently taken it, in the month of June. At Chelsea, a few miles from this city, it was very abundant one season, individuals being observed on every tree examined in a grove of beech. It may be readily recognized among our snout-beetles by it greater size, being five-eighths of an inch long, and robust. Beak, broad and stout with a ridge down the centre; thorax cylindrical, a little narrowed in front; elytra twice as wide as thorax, and declivous or pinched in at the apex to fit the corpulent body; colour greyish; the thorax with three indistinct pale stripes, and each elytron also with three whitish lines, interrupted with black spots, lower surface and legs whitish. Fig. 77.

Fig. 77.

35. *Cryptorhynchus bisignatus*, Say.—A pretty little brownish weevil, with an oblique white dash on each elytron, much resembling in shape the Plum Curculio but smaller and not tuberculated. Mr. Chittenden has found it upon both oak and beech trees and believes that it lives under the bark of these trees.

36. *Acoptus suturalis*, Lec.—Mr. Chittenden has taken specimens of this beetle from beech wood. It has been recorded by me (Ann. Rept. xiv., p. 50) as boring in hickory, and the following description was there given of it. A small, black beetle (length one-eighth of an inch), densely clothed beneath and more sparsely above with short yellowish hairs. The elytra are striated and in unrubbed specimens have a wide band of yellowish pubescence across the base, and a narrow one near the tips, which are black, as is also the space between the bands; a white line along the suture interrupts the basal band.

CALANDRIDÆ

37. *Phlœophagus apionoides*, Horn.—This is a very small and narrow blackish weevil about an eighth of an inch long, with punctured thorax and striated elytra, which Mr. Chittenden found to occur upon the beech with the species just mentioned, and which he believes to breed in the wood likewise.

36. *Phlœophagus minor*, Horn.—As its name indicates this species is smaller than the preceding, but otherwise closely resembles it, except in being of a paler colour, a reddish brown. Mr. Chittenden states that it breeds in the beech and also occurs on the elm.

38. *Stenoscelis brevis.*—This species which is stated to breed in the wood of beech has been found by me also infesting oak, hickory, maple and poplar. It is a black cylindrical beetle, one-eighth of an inch long, with faintly punctured thorax and striated elytra; beak short and smooth, giving it much the appearance of some of the bark-borers which belong to the next family.

SCOLITIDÆ.

39. *Monarthrum fasciatum*, Say. This little species bores in the living tree in the same manner as the Apple Bark-borer (*M. mali*, Fitch) which infests the apple, and which it much resembles.

40. *Xyleborus obesus*, Lec.—This is also a small insect which bores in the living tree, and which much resembles a destructive species (*X. pyri*, Peck) which attacks the pear and which has been named the Pear Blight Beetle.

NOTES ON THE SEASON OF 1896.

By J. Alston Moffat, London, Ontario.

The season commenced early and gave promise of being a good one for the collector, but soon showed symptoms of failing to fulfil its promise. The conditions here were unusually favorable for the production of luxuriant vegetation, and might have been considered equally so for the maturing of insect life, and yet the season was marked by a noticeable absence of that profusion usually seen in the early part of the summer particularly. And this seemed to be the experience of all the regular collectors I met with. When asked as to their success, the unvarying reply was, "There is nothing to be got." And yet, on the other hand, Mr. Bryce, an electric light trimmer, made during the season a large and varied collection of moths; not damaged ones taken out of lamps, but fresh specimens in good order, taken mostly at rest in the vicinity of the lights. When looking at that collection one felt like saying that there could have been no scarcity of good material, but it only proved the value of electric light as a means of concentrating them at particular places for observation, and also, that insects have to be somewhat abundant to become conspicuous. The only moths that attracted my attention about the lights were species of *Crambidæ*.

The climatic conditions in the southern portion of Ontario were remarkably diverse within short distances, the western section having a superabundance of moisture, whilst the eastern section was proportionately dry, vegetation of all kinds there suffering severely from want of rain; yet there were two injurious insects that seemed to prosper equally well under either condition, namely, the Colorado potato beetle and the imported cabbage butterfly, both being unusually plentiful.

The newspapers reported grasshoppers as causing considerable damage in specified localities, but within the range of personal observation, they were noticeable mostly for their absence. Even in the dryest localities visited by me they could not be called abundant.

As was to be expected, after such a superabundant overflow of *Hadena arctica* last season, the next would be one of corresponding scarcity of the same species, and so it proved to be. Three specimens of it came under my observation, and three only. Many writers have a fondness for giving columns of figures that are perfectly appalling, illustrative of the natural cumulative increase of insects in a given number of generations, and the unsuspecting reader taking that as the unvarying rule in nature, reasonably concludes that if any species is particularly plentiful one season, it must necessarily be much more so in the following one, and consequently anticipates its advent with more or less alarm; but nature, which is full of surprises, has an easy method of confusing arithmetical calculations, or even of running counter to them. Long continued observation has led to the conclusion that the rule in nature is rather that an unusual outbreak of an insect in one year will be followed by a more than usual scarcity of the same species the next.

Two things are necessary for an abundance of any insect form. First, plenty of eggs; second, favorable conditions for the maturing of the same, in which must be placed an absence of living foes. A noticeable outbreak of a destructive insect is not necessarily preceded by an unusual number of producers. If all the eggs of any species of insect in any year were to come to maturity, there would undoubtedly be a noticeable increase of that species. But as a rule, it is a very small percentage of the ova of any insect that reaches maturity, many natural causes combining to reduce their numbers all along the line of their advance towards that consummation, and thus the balance is maintained between contending interests. This is what is known in scientific phraseology as "the struggle for existence," a delightfully brief but vague expression that covers much ground but explains nothing.

It would be a great satisfaction to be able to give a direct answer to the question so frequently put as to the cause of the abundance or scarcity of some insects at particular

times, but with creatures that work so much in secret as insects do, it is probable that it can never be done. When an unusual outbreak of any injurious insect occurs we can say positively that the conditions for its coming to maturity had been particularly favorable, but that includes all the climatic conditions, whether these were wet or dry, cold or hot, steady or fluctuating, and as these influence different species in different ways, the uncertainty is the greater; then there is food supply in the past as well as the present: the absence of predacious enemies, parasitic fungi and such like; they may also cover the character of the cultivation of that locality, as that may form a harbor and encouragement to the increase of pests,—an extent of varied knowledge which no one is likely to be in a position to possess. And so with their absence or great scarcity in other years, we can say positively that the conditions were not favorable, but just what these were it may be impossible to specify, especially by one who was not in the locality and had no opportunity of observing the conditions.

The first really serious and wide-spread outbreak of the army-worm, *Leucania unipuncta*, Haworth, in Canada, having occurred the last season, was the means of directing general attention to that destructive insect; and was productive of much newspaper correspondence. I had an opportunity of seeing the worm in the flesh, for the first time to my knowledge, and inspecting its work; and this is how it was obtained:

Being on a visit to Hamilton in July, I was invited to spend the evening of the 22nd, at Boulderwood, the charming summer residence of Mr. and Mrs. B. E. Charlton. It is situated on the brow of the mountain, adjoining the north or city side of the asylum grounds. On our way up, Mr. Charlton informed me that the army worm had invaded the asylum grounds, and was destroying the crops; and he proposed that after dinner we should visit the locality, and survey the invading army; which we accordingly did. We obtained the guidance of the farmer of the grounds, who led us to the infested field, which was at the extreme southern end of the asylum farm. He said they were first noticed in a field of oats, and on the other, or southern side of the road from his, and that the owner as soon as he knew they were there, cut his oats and shocked them in the field. The next day when he examined his shocks he found the ground under them a mass of worms mingled with oats. The asylum farmer at once ordered his to be cut, but had them carted to a far distant field and there put up in shocks.

The crop next north of the oats that had been cut and removed, was spring wheat. There we had evidence of what the worms could do. Not a loose leaf was to be seen in the field; the straw standing quite naked. It had begun to ripen, which probably had saved it and the heads from attack, as some of the short and greener ones showed signs of having been nibbled at. We found a number of the worms under clods, but the farmer expressed surprise at their being so scarce, as compared with the previous day, when a pint or more of them had been taken in a very short time, which had been wanted for exhibition purposes. Probably the bulk of them had gone to seek fresh pasture, as there was not a green leaf in that field left for them to eat. Some of those taken seemed to be full grown, and may have been preparing to pupate, as chrysalids were found. During the search Mr. Charlton found a creature which was to us of doubtful parentage. I thought I recognized it as something I ought to know, but could not say what at the time. Having surveyed the situation to our satisfaction; and Mr. Charlton having secured three of the largest worms in a box, the unnameable creature and a chrysalid; we returned to his residence. After these had been looked at by the residents and visitors assembled, the time came when I had to leave; Mr. Charlton kindly said I might take the box and its contents, which I was very pleased to do; so I put it in my vest pocket, which it just fitted. Upon reaching my place of abode, I took out the box to show my friends the army worms; when I opened it, I found the largest one had disappeared, except the head and shrivelled skin, which was about the size of a grain of wheat, whilst the unnameable creature had another one by the middle, and was quietly engaged in absorbing its internal economy with unmistakable satisfaction. This disclosure of its habits at once suggested to me that it was the larva of some predaceous beetle, probably an *Harpalus*, and that I had seen an illustration of it somewhere. Upon

returning to London and making search, I found its exact counterpart on an enlarged scale in "Saunders's Insects Injurious to Fruit," page 185, which is here reproduced, Fig. 78.

During the next day, the *Harpalus* larva rested quietly, two worms seemingly being enough to satisfy its cravings for one day; whilst the remaining worm was very restless, no doubt from want of food. In the evening, being in company the army worm was introduced in the conversation, when I remembered that I had the box in my pocket, I took it out to show the worm, but there was not the vestige of a worm left, and the *Harpalus* larva was rushing frantically round in the box in search of more. I kept it that night to see if it would attack the chrysalid, but it did not, so I gave it its liberty next morning in consideration of the good it might do.

Fig. 78.

A great deal of romance has been written upon the army worm. Its sudden appearance in vast and destructive hordes is well calculated to arouse the imagination of those who are usually totally indifferent to, and wholly ignorant of the habits of insects; consequently the movements of the army are to them perfectly mysterious. We read of their coming, no one knows how, or from where, of their always travelling to one particular point of the compass. Of their following a leader who directs their movements; and who gives the signal for their advance by a wag of his head; and much more of the same sort. The army worms come from eggs, like all other insects, which in this case are laid near the roots of grasses by the moth *Leucania unipuncta*; and may be feeding there in great numbers when young, without attracting the slightest attention. It is not until they are well grown that they acquire their great powers of destruction, and then the field in which they were born may not be able to sustain all of them; when the necessity to travel to other localities in search of food is forced upon them. The only really mysterious thing about their movements is, that they should keep together in a body, and go in the same direction in search of food, instead of, as is usual with caterpillars, each going in the direction that its fancy leads, independently of the others of its kind. This gregarious habit is indeed very wonderful. But food is their objective point of travel, not any particular one of the compass.

There is another destructive insect that is endowed with this peculiar habit of travelling all together in one direction in search of food, namely, the migratory locust in its mature state; and a consideration of its mode of progress in desolating a region, may assist us in forming an idea concerning that of the army worm. When we read of an invasion of locusts into a locality where there were none before, they are always represented to us as coming down from the air above, ravenously hungry, as if it had been their first stopping place for food on a long journey, a few at first, then a dense mass, sufficient at times to obscure the light of the sun, gradually becoming thinner, then passing over, not leaving any living green thing behind them. This appearance, although it may be misunderstood by the onlooker, is nevertheless quite in harmony with the actual facts of their progression. Supposing a field well stocked with locusts who have just developed mature wings and a prodigious appetite, find their food supply exhausted, and it has become needful for them to go elsewhere for more. The field next to them is untouched, those close to it enter, those behind them follow, whilst those at a distance who are as eager for food and in as great a hurry to obtain it, rise on the wing and fly over the feeders and alight just beyond them, their peculiar gregarious instinct compelling them to feed in crowds, so that those that entered the fresh field first, find themselves surrounded by a multitude which has devoured everything before they get enough; hence they in turn find it necessary to rise on the wing and make for the front again to obtain more and so having started they proceed; and the deeper and denser the advancing host, the further they have to fly to reach the front, and the more of them there are on the wing at one time, the higher some of them have to rise in the air to get over the others; and when we read of their coming down in such numbers and such

force, as to remind the beholder of a hailstorm, and make him glad to seek shelter from their contact, it is in perfect accord with their mode of progress and their eager haste to obtain food; and this mass, to a beholder who could take it all in at once, would appear like a huge rolling crowd of living particles, descending in front but ascending at the rear, whilst the impelling force that keeps it going is the necessity for something to eat. And when we consider the meagreness of the supply in some localities, compared with the enormousness of the demand that always exists, we get the reason for the differences of time that they take on the way. If food is abundant, they linger; if it is scarce they pass rapidly on. When we turn our attention again to the army worm, we see that the principle and the motive are the same in both; but the one proceeds on the wing, through the air, whilst the other has to keep on the ground and go afoot; yet the front ranks will be constantly changing places with the rear, for as those in front stay to eat, those behind have to pass beyond them to obtain a share; and as the feeders are so numerous in one place, none of them get all they want, so they are compelled to move on to get some more; which completely disposes of the "leadership" theory.

Amongst the captures here of rare forms during the past season, I may mention a specimen of *Papilio Marcellus* by one person, and one of *P. Philenor* by another. *P. Cresphontes* again paid us a visit, after an absence of two years. It appears as if this southern butterfly must be either periodical in its habits, or has not yet succeeded in firmly establishing itself in more northerly localities; and is depending upon additional migrations to maintain an appearance. In the year 1893 it was more abundant, and reported from a greater number of localities, and some of these further north than ever before. In 1894 I saw a few in the early part of the season, but none later on. In 1895 I did not see a single specimen on the wing, nor was there one reported to me as having been seen. In the latter part of August, 1896, I saw a fine fresh specimen, but did not secure it, I also saw one that was taken later in the season in a damaged condition; which would seem to give promise of its being more plentiful again next year.

A specimen of *Erebus odora* was taken by Mr. Kyle, at Dundas.

The things new to this locality, recognized in Mr. Bryce's collection, were the true Carolina Sphinx, as distinguished from *quinquemaculata*. Large in size, dark in colour, and in fine condition. *Cisthene unifascia*, Grote, bright and fresh. Mr. Bryce has kindly donated a specimen of each to the Society's collection. He has also taken a single specimen of *Aspila virescens*, Hub. Also many choice varieties of less rare things, as well as several species not yet determined. Never did I see the webs of *Hyphantria cunea*, the fall web worm, so offensively obtrusive as during the past season.

In the early part of October the males of *Hybernia tiliaria*, Fig. 79, the Lime-tree Winter Moth, were in great profusion around the city. They could be seen even on frosty nights, fluttering about the lighted shop windows, and in daytime resting in sheltered places, or being driven along the street by the wind; their large sail-like wings affording ample space for catching every breeze, and being carried helplessly away by it. There was a wonderful, and particularly interesting diversity in the shade and pattern of the colour and ornamentation of their wings, which their abundance gave one a good opportunity to observe. The females I did not see; as these are wingless they would require to be sought for upon the trees.

Fig. 79.

WARNING COLORS, PROTECTIVE MIMICRY AND PROTECTIVE COLORATION.*

BY F. M. WEBSTER, WOOSTER, OHIO.

In "Memoires de la Societe Zoologique de France," Professor Felix Plateau has recently given the results of some experiments carried on by himself, to determine whether, as has often been stated, the Magpie moth is really an example of what is termed "warning color." In order to solve the problem, the Professor ate several of the caterpillars, and found them to possess something of the flavor of almonds, and not unpleasant to him, but rather the reverse. Unfortunately, this experiment only proves that as against a person to whom the flavor of almonds is not distasteful, the larvæ of the Magpie moth are not warningly colored, but the real question regarding protective coloration, as against bird enemies, does not appear to be nearer a solution than it was before. Men do not feed upon the larvæ of this moth, or the moth itself, nor have we good reasons to suspect that they have ever done so, and there is no reason why these caterpillars should be, to them, distasteful, as no material protection would in any case result. The two following incidents will illustrate my point.

Species belonging to the genus Danais are, rarely, if ever, to any extent attacked by birds, and in the tropics even monkeys are said to reject them. In the United States, *Danais archippus*, (see Fig. 27, page 31), is mimicked by *Limenitis disippus*, (Fig. 80), and in other parts of the world other species of the former genus are mimicked by still other species of butterflies, some very interesting illustrations being given by Mr. Roland Trimen in his paper on "Some Remarkable Mimetic Analogies among South African Butterflies."† In the United States, *D. archippus* breeds in the north, and in autumn migrates in immense swarms to the south, where it hibernates through the winter. In "Insect Life," it is stated‡ that these butterflies are sometimes attacked in their winter quarters, and great numbers of them eaten, by a mouse belonging to the genus *Onychomys*; one of the grasshopper and scorpion mice. On an island in Aransas Bay, on the gulf coast of Texas, the remains of at least twenty-seven individuals were found in one place by Mr. Attwater, thus showing that the species is not distasteful to this mouse, but by no mean disproving that to other animals, and to birds, it is distasteful, and for this reason mimicked by other species of butterflies. This mouse is not a persistent and perpetual enemy, and unrestrained does not threaten the extermination of the species, and protection from it has never become necessary, and is not now essential. The Harlequin cabbage bug, *Murgantia histrionica*, (Fig. 81), is a conspicuously colored, tropical species, that has made its way northward as far as Lat. 40° 48′, even the egg being white banded with black. Not only does the species feed during its entire life, in all stages of development, in the most exposed positions, but the eggs are placed in clusters equally exposed, every habit, in fact, indicating a total disregard of the presence of natural enemies of any description, thereby implying, though not proving that it is distasteful if not warningly colored. Some time since I had

Fig. 80.

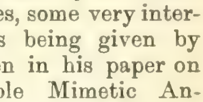


Fig. 81.

*Read before Section F, Zoology, of the American Association for the Advancement of Science, at the Buffalo, N.Y., meeting, August 25th, 1896.

†Linn. Soc. Trans. Vol. XXVI., pp. 497, *et seq.*

‡Vol. V., p. 270.

occasion to confine a number of these bugs in a greenhouse upon cabbage plants over which a breeding cage without a bottom was placed, earth being banked up about the base of the cage. The bugs had been thus confined for a short time when during the night, mice worked their way under the side of the cage, and in the morning all that remained of the bugs consisted of a confused lot of heads, legs and fore wings, the mice having clearly eaten the confined bugs during a single night. Still, as against persistent and continual enemies these bugs may be and probably are distasteful, mice being only occasional or accidental enemies.

In commenting on the experiments of Professor Plateau, "Science Gossip," perhaps somewhat overestimating the value of the results obtained, says:—"It would indeed be well if all the examples of 'warning coloration' were subjected to as careful an examination. Equally cautious also should naturalists be before accepting examples of 'mimicry' among animals and plants In some cases the so-called 'advantageous mimicry' falls to the ground, for the insect which is supposed to imitate one of its fellows appears at quite a different time of year from it."

Now, caution is a grand virtue, and should be, always, the investigators watchword, but to be over cautious is to cheat ourselves and each other out of the truth, which practically amounts to little less than carelessness. He who cautiously winnows the grain, will be as careful that none is blown over with the chaff as he will be to keep the latter from falling back into the cleaned grain, as, in either case, his work will be but poorly done.

By the way, has it ever been settled, beyond question, that both the species protected and the one protecting must occur, interspersed together, over the same area, and at the same time of year? Would either the ornithologist or entomologist be greatly upset if he were to find that birds which had learned, by experience, in spring and while yet very young, to shun insects of certain peculiarities of colour and movement, or which appear to them to possess such characteristics, should continue to follow the same course in late summer or autumn? How soon do birds forget past experiences, and cease to profit by them? After having learned that certain insects, having certain peculiarities of color or of action are not fitted for food, will they not rather continue to profit by such experience, and avoid such at whatever time of year and wherever they encountered them? Besides, does all of this education have to be acquired by experience, or does heredity not exert an influence more or less important?

The adult of the Hickory tree-borer, *Cyllene pictus*, develops chiefly in *Carya*, and emerges in spring, being almost exactly reproduced, so far as form and colour are concerned, in the Locust tree-borer, *Cyllene robiniæ*, which develops in *Robinia pseudacacia*, and emerges in late summer. Both of these species are supposed to mimic wasps, but we will suppose that both wasps and borer have disappeared before the latter species of borer has emerged; would it not gain some protection from its close resemblence to the borer that had preceded it, several months earlier? Would entomologists be very much astounded if such conditions should be found to obtain among other species?

Adults of our *Podosesia syringæ*, resemble, very closely, both of our common species of Polistes, *P. annularis* and *P. metricus*, especially on the wing, and when at rest the abdomen of the moth is bent downward posteriorly and kept in constant motion, precisely as with the Polistes. If the moth is on the ground it does not readily take flight, or, like many other moths remain quiet, but moves about in precisely the same manner as the wasps. In this case a defenceless moth is not only, in all probability, protectively colored, thereby resembling an entirely different insect, armed with a formidable weapon of defence, but its movements are equally like those of the armed species, so that it must gain protection thereby, to greater or less degree. But if one were to hunt for *Polistes*, he would hardly select for his collecting ground a lilac bush long since out of bloom. He would be far more likely to search for them on flowers, where he would seldom if ever find *Podosesia*.

Do we not here have grounds for doubting the necessity for the mimicking and mimicked forms occurring together over the same area, and if so, how far may they not

be separated, and the former gain more or less protection from its enemies? Is it not more probable that birds and other natural enemies will avoid species having a close resemblance to armed or distasteful species, during their entire life, and wherever they may go? Will not birds that have hatched and reached maturity in the north and there learned to avoid armed or inedible species of insects, or such as closely resemble them continue to follow the same policy respecting the latter, after they have migrated far to the southward, and may not the recollections of *Polistes annularis* offer protection to species resembling it, like the *Podosesia syringæ*, for instance, far beyond the geographical distribution of the former species itself? Unless birds are continually forgetting and having to relearn past lessons, we must certainly admit that protective mimicry and protective coloration may be in effect, over the entire area of distribution of the species deceived, even though this extend far beyond the area occupied by either the mimicking or mimicked species, though, as a matter of course, this influence must decrease as the deceived species are displaced by those new and untried. It would certainly seem that we might here find a solution of some of the very many perplexing problems of form, movements and coloration, that are constantly confronting the student of animal life.

That at least birds and animals do not readily forget old habits and former experience, especially if the lesson has been emphasized by pain, I will give two illustrations, one borrowed, the other my own, and doubtless many others will readily occur to anyone who will take the trouble to recall them.

In his exceptionally valuable work, "The Naturalist in La Plata," all the more valuable because of the author studying life in living forms, and speaking only of what he observed, Mr. W. H. Hudson, informs us that in that treeless country some species of woodpeckers have, through necessity, acquired the habit of seeking their food on the ground, and even nesting in the banks of streams, yet where this change of environment and consequent alterations in their way of living, have, in some cases, resulted in structural modifications, thereby showing their antiquity, they still retain their primitive habit of clinging, vertically, to the trunks of trees (presumably introduced) though the habit has long since lost its use. We thus have evidence, not only of the permanency of established food habits, but that habits of this sort are transmitted through long periods of time through the influence of heredity.

Years ago, when sparsely settled and therefore in a nearly primitive condition, the prairies of Illinois, where the greater part of my childhood was passed, were inha snakes of various species. My father owned a pair of oxen, one of which had, when a calf, been bitten by a snake; an experience that he never forgot. So long as he was retained on the farm, he could seemingly not only detect the presence of these reptiles by sight, but if out of sight and near at hand he appeared to scent them as unerringly; and once he detected the presence of a snake, of any kind or dimensions, he would give a snort and with a deep bellow break for home, whether attached to plow, harrow or waggon. On one occasion, with my father, I was crossing a track of prairie in early spring. The dry grass of the previous year had been burned and the ashes had disappeared, leaving the surface bare and brown, as the young grass had not yet put forth. I, at the time a very small lad, was in the waggon, while my father walked along beside the oxen. Suddenly "Old Star" gave a snort, and with a bellow that seemed to frighten his mate also, started off on a mad run, taking a bee line for home, not stopping until their stable had been reached. After assuring himself of my safety, my father returned to the place where the oxen had started on their wild run, and near by found a group of snakes that he had not before observed, belonging to a harmless species, collected in a confused mass, as is their habit at this season, enjoying the warm rays of the early spring sun. It does not seem probable that the sting of an insect would have a less lasting effect on a smaller animal or bird, or the recollections of a particularly distasteful morsel in the mouth soon become extinct, and besides, my father's ox would probably not have acted differently, or any sooner forgotten the pain of the snake bite received on the prairies of Illinois, had he been transferred to New England or California.

Along the south shore of Lake Erie I find two species of Hemiptera,* *Salda ligata*, Say, and *S. interstitialis*, Say, the latter and smaller, when skipping nimbly about, as Mr. Say stated that it did on the shores of the Missouri River, have a deceptive resemblance to so many stranded *Hydrophorus*, which I believe prefers such places to sandy beaches; and along Lake Erie at least they are far outnumbered by this species of *Salda*, which so closely resembles them. *Salda ligata* is larger and does not resemble any of the aquatic beetles found along the lake, but simulates to a remarkable degree some of the species of *Bembidium*, though at the time of my observation it was impossible to find a single representative of this genus in that immediate locality, whereas, they were most surely to have been found along the shores of almost any stream. Now, these two species of Hemiptera not only closely resemble species of beetles not present, but inhabiting quite similar places elsewhere, but also the movements of one species of Hemiptera add much more to this deception than does its color, thus raising the question as to whether these peculiarities of color and movement are mere coincidences, and of no service to the possessors, or whether they do receive benefit from such simulations by taking advantage of the lessons learned by the sand piper, or other birds of similar habits, along the shores of some distant inland stream, and which lessons caused them to shun insects having these peculiarities of form, movement and color. Is the investigator justified in casting aside the whole problem, because he does not happen to look far enough to see all of the factors entering into it?

On the extreme tips of the new growth of pine, a tree not indigenous in the locality where these observations were made, I find during June and July, a *Capsid*, *Pilophorus amœnus*,† which while at rest has much the appearance of some species of the Coleopterous family, *Cerambycidæ*, no species, however, being at all common on this tree, in this locality, though *Euderces pini*, is said to occur elsewhere on the pine. While moving about among the pine needles, however, the Pilophorus has almost exactly the quick, active, erratic movements of ants which frequent the same situations in considerable numbers, the Capsid, except when at rest, being almost indistinguishable from them. If all of this deception was for the purpose of misleading the ants, it would seem as though it would have been carried further, and obtained while the Capsid was at rest. The tips of these pine twigs are practically inaccessible to even the smaller arboreal birds, and against these protection is here unnecessary, while except an occasional spider, invertebrate enemies are equally wanting. In fact, so far as the need for protection in this particular situation is concerned, the whole matter of protective mimicry would fall to the ground, as no protection appears necessary, yet, it seems to me, that the careful investigator would not be justified in dismissing the whole matter as a mere coincidence, but rather in searching elsewhere for the causes of a phenomenon of which the effects only are here perceivable. The polished surface of the abdomen of an ant reflects the rays of light in such a manner as to appear like a narrow band of white, of which the transverse white fascia on the wing covers of *Pilophorus amœnus*, when that insect is in motion, appears almost the exact counterpart. I have never observed *Euderces pini* in life, but it does not seem impossible that it too may move about in a similar way, and both together mimic the ant where protection is necessary, my observations being made where but two of the three actors are present, and no protection necessary.

Another diminutive Capsid, *Halticus bractatus*,‡ is found in Ohio, and among other plants affects Red Clover, *Trifolium pratense*, feeding in all stages upon the upper side of the leaves. The effect upon the plant is to discolor the leaves, but this really affords protection to the young, as the changed color more nearly harmonizes with that of their bodies. The adults are black with antennæ and legs, except the femora, yellow, the femora being also black, both sexes being saltatorial. The male has the normal form of an Hemipter, but the female differs entirely in appearance, and simulates to a remarkable

*Kindly determined for me at the Department of Agriculture.

†Kindly determined by Professor Herbert Osborn.

‡ Also determined by Prof. Osborn, who, with my assistant Mr. C. W. Mally, found the species quite abundant in Iowa, the latter gentleman observing it also in Northern Ohio.

degree, a beetle, *Chatocnema parcepunctata*, also very common on clover and other plants. Curiously enough, where I find the former in greatest abundance, there are almost none at all of the beetles, while in a clover field not over one-fourth of a mile away, the beetles are very abundant and none at all of *Halticus bractatus* That we have here a well defined case of simulation can hardly be doubted, yet the simulating form and the form simulated avoid each others company as if mortal enemies, there being no other forms present that at all resemble them.

I have made no experiments with any of these insects in order to determine whether or not they are distasteful, for the reason that any results obtained with the facilities at hand would have added to instead of reducing the complication I might, like Professor Plateau, have eaten some of these insects, and learned whether or not they were distasteful to me, or I might have fed them to domestic fowls, or wild birds in confinement, but failed entirely of securing the data required. It seems to me that the only testimony in these matters, worthy of consideration, is to be found in the stomachs of insectivorous birds, and other vertebrate enemies if any, shot while feeding in the exact locality and under perfectly free and natural conditions. Giving a bird perfect freedom and allowing it to make its own selections and discoveries is one thing, while confining it, and doing these things for it, is quite another. It is what these natural enemies actually do, under perfectly natural conditions, that we must learn, and not what they can be induced to do.*

Over a large portion of the United States, and to a less extent in Canada, primitive conditions no longer obtain, while modern conditions are undergoing a constant change, the plow and axe of the husbandman having exterminated many forms, both vertebrate and invertebrate, if not entirely, over large tracts of country, and we may and probably do have cases of peculiar coloration and movements that were once protective, but now remain only as vestiges of a former state of affairs, the forces that brought them into existence no longer existing, except locally.

One phase in the radical changing of the natural flora and fauna over areas of greater or less extent, whereby both plants and insects are entirely displaced by others, emphatically different, is shown by the two accompanying illustrations, showing the bed of a small lake just prior to and after being brought under cultivation, and an aquatic insect fauna displayed by another, terrestrial, and more or less connected with the introduced flora. (See plate preceding, page 65).

In Northern Illinois a species of willow, *Salix discolor*, the leaves of which are nearly white on the under side, grows in wet places, on hummocks, and to the height of from one to six feet, forming a regular compact cluster. The foliage is fed upon by a hard, heavy bodied beetle, an inch or more in length, and often nearly a half inch across the shoulders, in color ebony black with white pubescence, which on the elytra is arranged in irregular transverse fasciæ, with more or less parallel markings, all of which combine to give the insect the appearance of a white surface, irregularly tessellated with black. This beetle, *Plectrodera scalator*, fig 82 feeds by eating holes in the leaves, or irregular notches, leaving the mid and lateral veins, with irregular borders of the leaf along these nearly intact. The beetle remains on the under side of the leaf, the eaten portions of which, against the background formed by the interior of the thicket, appear black, while the uneaten portions appear nearly white. In this way a beetle stationed on an uneaten leaf has almost the exact appearance of a leaf partly eaten, and so perfect is the deception that a fairly good collector may pass some years in a locality where the species is very common, without seeing a single specimen, until he detects the deception. Aside from its considerable dimensions and hard body, this beetle is armed with a rather formidable spine on each side of the thorax, thus rendering it rather an undesirable sort of prey for any of the smaller birds, and altogether too much so for any invertebrate enemies. In

Fig 82.

* I may be permitted to state that, in Ohio, birds cannot be shot for the purpose of making scientific investigations, without running the risk of being arrested and heavily fined therefor.

the locality in Illinois, where I studied this species, only two vertebrate enemies can be said to exist, one the Skunk, *Mephitis mephitica*, and an occasional entomologist, neither of which are at present abundant. Does it appear likely that all of this is brought about by mere accident, or is it not far more probable that protection was once gained, and elsewhere the deception may continue to give protection?

There are still other points in this problem that seem well worthy of careful consideration. We hear the terms, warning colors, protective mimicry and protective coloration, etc., used, as a rule, in the sense of a finality. Just as though these particular workshops of nature had finished their mission, and were now closed indefinitely; and while we have ample supplies of the finished product, there is none at all in process of construction. Have we here no transition stages? We are dealing with some of the forces that go to make what we term evolution, a process going on, as is believed, continually and everywhere about us, and if this is true might we not confidently look for species and varieties that are in the process of becoming protectively, or even warningly colored, or the condition which we term protective simulation not quite obtained? If perfect protection is never quite reached, does not this of itself presuppose progressiveness and, therefore, instability? May we not, in fact, in the future come to measure the antiquity of some of our species by the degree of perfection with which they are mimicked by others? It would probably necessitate remaining together through a long period of time in order to enable an unprotected, younger and therefore less stable form to gain protection from a distasteful form, especially as the advance in that direction must necessarily come from the weaker, unprotected and younger form. To illustrate, our *Danais archippus* is supposed to be a very old species, while *Limenitis disippus* is supposed to be a much younger species. What is true here would also obtain in the case of *Podosesia* and *Polistes*, thus indicating the greater antiquity of the latter, though probably belonging to a younger order than the former. Mr. Gahan has shown* that there is a remarkably close resemblance between seventeen species of *Diabrotica*, inhabiting Mexico and Central America, and an equal number of species of the genus *Lema* occurring in the same section of country. Among the species of *Diabrotica* given, but one, *D. vittata*, is known to occur north of Mexico, and none of the species of *Lema* here sufficiently resemble any of the species of *Diabrotica* to lead to the suspicion of protective mimicry. In fact, it is only along the Mexican border that we have any striking resemblance between any of our species and those of the latter genus. In the states bordering on Mexico, Professor Wickham tells me that *Andrector 6-punctata* bears a striking resemblance to *Diabrotica 12 punctata*, and another species of *Andrector* is very much like *D. tricincta*. There is no positive proof that these are cases of protective mimicry, and Mr. Gahan does not claim this for the cases of close resemblance to which he calls attention, but in all of these there are certainly strong grounds for suspecting that such will ultimately prove to be the case. I have elsewhere †shown that there is every probability that the ancient home of the genus *Diabrotica* was in northern South America, many North American species originating in Central America and Mexico. It would seem, then, that *D. vittata*, *D. 12 punctata* and *D. tricincta* having spread northward from Mexico, and being the oldest northern forms of the genus, might be mimicked in Mexico and the adjacent portion of the United States, because of having occurred there a sufficient length of time for such conditions to be brought about, while farther north they, with the rest of the genus, are comparatively recent comers, and sufficient time has not elapsed to develop cases of protective mimicry.

In conclusion, I desire that nothing in this paper shall be so construed as to, in the remotest degree, favor hasty or unwarranted conclusions in studies of warning colors, protective mimicry or protective coloration, but I do wish to urge that the same caution and painstaking labor should characterize our action in rejecting, finally, possible cases of these phenomena that would be exercised before accepting such, were the possibilities

*Trans. Ent. Soc. Lond. 1891. pp. 367-374.

†Jour. N.Y., Ent. Soc. Vol. III., pp. 158-166.

greater or amounting to probabilities, that we shall lean no more or less to the pessimistic than to the optimistic, but weigh every fragment of information, be it negative or affirmative, with equal care and discretion.

The points that I have tried to emphasize are :—(1) That a form of animal life may be distasteful to other forms, and so far as these are concerned, warningly colored ; but neither the one or the other, where the form to be protected from is not a persistent and perpetual enemy, that, unrestrained, would threaten the extinction of the form preyed upon ; (2) That a mimicking form may profit by a protective resemblance, not only where both it and the form mimicked occur together, but throughout the area of distribution of the deceived form, whether the mimicked form be present or not ; (3) That a form, closely resembling in appearance a mimicking form, though occurring at a different time of year, or in a different locality, may profit to a greater or less degree by such resemblance, even though both mimicked and mimicking forms are absent, provided, however, the form protected from has somewhere come in contact with the distasteful form and learned by experience that it is inedible ; (4) That we may and probably do have cases of partial deception, and, therefore, partial protection ; (5) That cases of mimicry may occur where, owing to the fact of the enemies having become exterminated, or the mimicked and mimicking forms drifted into places inaccessible to such enemies, no protection is given or required ; (6) That these problems are most far reaching, and we have as yet scarcely begun to study them in their entirety, hence the fragment hove over among the rubbish may yet prove to be the keystone of the archway through which we are to make our way into one of the grandest and most sublime of nature's many temples.

THE SAN JOSE SCALE.*

By F. M. Webster, Wooster, Ohio.

My topic is not of my own choosing, but the one assigned me by the Vice-President and also by the Secretary of the American Association of Nurserymen. I mention this fact, not in the way of compliment, but because so much has been said in public print regarding this pest during the last year or two, that I may not be able to present much that is new. About all that I shall attempt to do will be to bring together all the facts in our possession and point out to this association, for its consideration, some lessons that the past has taught us, and the possibility of profiting by such lessons in the future. To me, though not a nurseryman but one whose business it is to protect some of their interests, the introduction of the San José scale into the country lying to the east of the one hundredth meridian, and its suppression, so far as this has been accomplished, has meant something more than the mere study and investigation of the pest ; more even than the overcoming of it and preventing its further diffusion. It has appeared to me as though, in the last half of the last decade of the nineteenth century, there had been presented to our people a test case, as it were, as well as a reminder that the coming twentieth century would bring to us problems which we had not previously been called upon to solve. The question that seemed to me to be involved was this : Can a republican government, composed of nearly half a hundred minor governments, protect its people from the ravages of a diminutive insect pest that has been introduced among them to devastate their orchards and fruit farms ? What will be done under such circumstances, and who will be the ones to do it ? This scale is a serious pest, but is it not, besides this, the straw that denotes the direction toward which the wind is blowing ? We have but to cast our eyes toward the State of Massachusetts where a fierce battle is being carried on against another imported pest of our orchards

* This valuable paper, read at the Twentieth Annual Meeting of the American Association of Nurserymen, at Indianapolis, Ind., June 12th and 13th, 1895, has been kindly furnished us by the writer, and will be found well worthy of perusal in view of the fact that this insect may at any time be found in Ontario. —Ed.

and forests, solely by one member of this republic, while the others are simply spectators looking on with a disinterestedness that amounts almost, if not quite, to a total indifference. These are the two at present, most important introductions of foreign insect pests, but no one can for a moment suppose that others will not follow, coming as with the San José scale, from we know not where. You, gentlemen, are engaged in a business that necessitates the exchange of scions, grafts, trees and shrubs, but may also be disseminators of these pests not alone to your customers, but to each other. And, whether you will or no, you cannot escape being foremost in the settlement of a problem that half a century ago was unthought of. Hence, while I address you on the subject of the San José scale, it will be to view it as a factor in what seems to me to be a great and difficult problem in the future of your business; and with this explanation I will proceed to consider that factor.

The San José scale was first observed in this country in the locality in California from which it derives its name, coming from we know not where, but probably from either some of the islands of the Pacific or else some of the Asiatic countries beyond. This introduction is thought to have taken place about the year 1870, and began to attract the attention of fruit growers about three years later, but so far as known only in the locality above indicated. In 1880 Prof. J. H. Comstock described the species, and wrote as follows: "It is said to infest all the deciduous fruits grown in California, excepting the peach, apricot, and black Tartarian cherry. It attacks the bark of the limbs as well as the leaves and fruit. I have seen many plum and apple trees upon which the fruit was so badly infested that it was unmarketable. In other instances I have seen the bark of all the small limbs completely covered by the scales. I think it is the most pernicious scale insect known in this country." For the reason here given, Prof. Comstock gave it the name of *Aspidiotus perniciosus*, and I may here add that it has since been found to occur on both the peach and apricot, and fully merits the name given it by the describer. It appears to have spread quite rapidly, for in 1882, nine years later, it had extended over all of the fruit growing regions of California and across Oregon into Washington. As late as 1893, the Los Angeles Horticultural Commission, in their report for that year, stated that the pest, if not speedily destroyed, would utterly ruin the deciduous fruit interests of the Pacific coast; that it not only checks the growth of the trees, but covers them literally entirely, and the fruit nearly as much so, and, if left unchecked, the tree is killed within three years' time. This will serve to show you the serious nature of this little pest, as demonstrated by its twenty five years' residence on the Pacific coast.

I will occupy a few moments here to consider its probable origin, though, as before stated, we do not as yet know the land of its nativity. It is found in Chili, but was clearly introduced to that country from California. It also is found in Hawaian Islands, having been introduced from California on prune and peach trees, and also in Australia. But nowhere in these countries has it been found inhabiting indigenous vegetation, which we entomologists claim, must be done in order to prove the nativity of the pest. Quite recently, Professor Cook has sent it from California on the Loquat, *Photinia japonica*, and, as will be observed, there are several of our forest trees included in Dr. Lintner's list, but this proves nothing as it would be surprising if, in its twenty-five years' residence in this country, it had not begun to adapt itself to our native flora, precisely as some of our native parasitic insects are beginning to learn that they can add it to their bill of fare. Considerable of the nursery stock required in California is grown on some of the smaller islands of the Pacific, as for instance, Tahiti, and it seems at least possible that we may in this way have acquired a pest that may be an inhabitant of an obscure island, and, for aught we know, it may be so inconspicuous there as to require the trained eye of the naturalist to detect it.

The insect itself, Fig. 83, belongs to a group known as armored scale insects, their nearest allies being the Oyster-shell Bark-louse, while still farther removed are the Mealy-bugs. We have here in the east a somewhat similar species that I have found on peach, plum, pear and maple. This is known as the Putnam scale, *Aspidiotus ancylus*,

having been first described by the late J. Duncan Putnam, from Iowa. It is known to occur on the following plants also, ash, beech, bladder-nut, hackberry, linden, oak, osage-orange and water locust. This is often mistaken for the San Jose scale, even by those

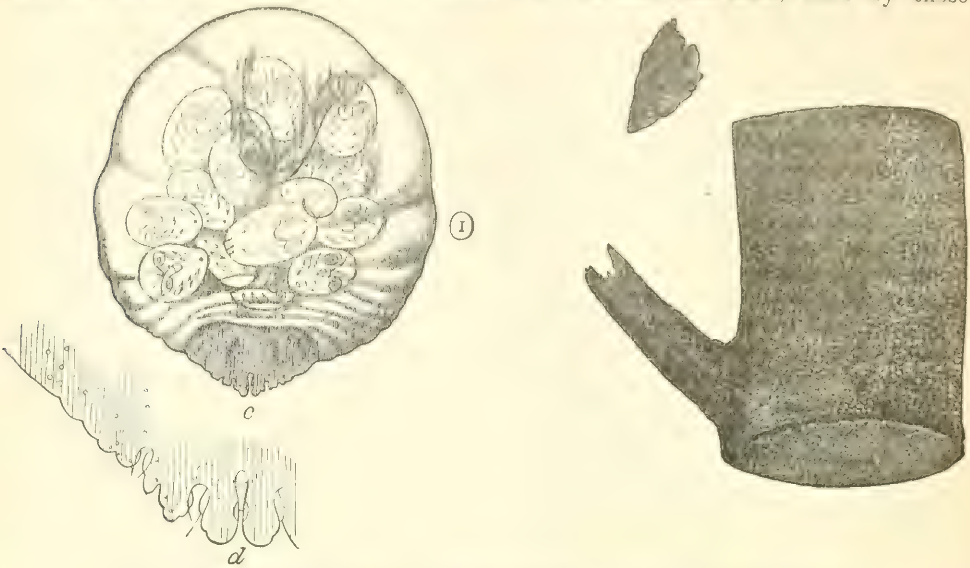


Fig. 83.—San José Scale, female enlarged and part of infested branch (life size.)

who are quite familiar with the latter. My own manner of distinguishing between these two scales is to first observe if the disc is circularly wrinkled and the elevation in the centre surrounded by a depressed ring; if the scale is very flat, or if it appears to rise

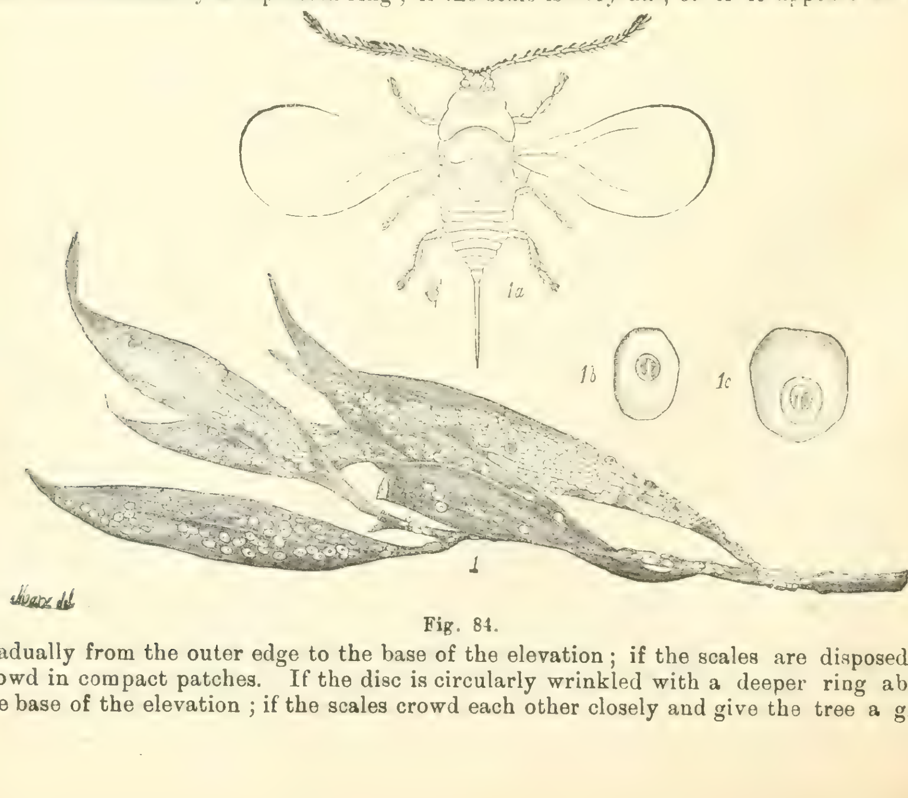


Fig. 84.

gradually from the outer edge to the base of the elevation; if the scales are disposed to crowd in compact patches. If the disc is circularly wrinkled with a deeper ring about the base of the elevation; if the scales crowd each other closely and give the tree a gray

appearance, it is the San Jose scale. If the disc is smooth, and the central point rises out of a smooth area, it is probably the Putnam scale. Another scale that has come to me several times as the San Jose scale, is the Oleander scale, *Aspidiotus nerii*, Fig. 83, which also attacks ivy. But this is of a lighter color, flatter and longer.

The Rose scale, *Diaspis rosæ*, has been sent me, both on the rose and raspberry, with the query as to whether or not it was the San José scale. But this is also larger, more depressed and of a lighter color. In short, we have nothing that clusters so thickly together on the host plant, and gives it that peculiar gray color, which once seen will never be mistaken for anything else.

In regard to the life history of the species now under consideration, it appears to differ from that of many of our scale insects in that instead of reproducing by laying eggs, the mother gives birth to her young. As by far the most careful studies made on this species have been carried on at the Department of Agriculture, under the direction of U. S. Entomologist, Dr. L. O. Howard, I take the liberty of giving Mr. Howard's statement in his own words. He says: "Although this insect has been known in California for about twenty years, its life-history has not been carefully worked out by California writers Professor Comstock described simply the male and female scales and the body of the adult female. The male was unknown to him. In his work on the Injurious Insects of the Orchard, Vineyard, etc., published at Sacramento in 1883, Mr. Matthew Cooke briefly described the male insect and published a crude figure of it He further stated that the species produces three broods in California, the first "about the time the cherries begin to color, the second in July, and the third in October." The statement is made by Comstock that the eggs are white," and Cooke further says that "each female produces from thirty-five to fifty eggs."

"Upon the appearance of the insect in the east, potted pear trees were secured for the Insectary of this division, and colonies of the scale were established on them. Their life-history has been followed with more or less care throughout the season, and the following brief statement of the life cycle of the insect is based upon daily observations made during the summer by Mr. Pergande.

"It has already been ascertained during the late summer and fall of 1893 that the insect is viviparous, that is, gives birth to living young, and that it does not lay eggs. We are unable to reconcile this condition of affairs with the statements just quoted from Comstock and Cooke, but it occurred to us that, as with certain of the plant-lice, there might be winter eggs, with viviparous females in summer. When winter came on, however, it was found that the insect hibernated in the nearly full grown female condition, and that these females, about the middle of May, began to give birth to living young as their ancestors did the previous fall. In no instance, therefore, have we observed the egg (unless the young still in the body of the female and enveloped in the embryonic membrane may be so called). Over-wintered females continued to give birth to living young day after day for six weeks. This condition of affairs produces, early in the season, a confusion of generations, which makes observations upon the life-history of the insect extremely difficult and only to be accomplished by isolation of individuals. It also seriously complicates the matter of remedies, since, as numbers of the larvæ are hatching every day, and as they begin to form their almost impervious scales in two or three days, a spraying operation at any given time will destroy only those larvæ which happen to be at that time less than three days old, while on the day after the spraying new larvæ will be born to take the place of those just killed.

"Observations upon isolated individuals show that the newly hatched larvæ, after crawling about for a few hours, settle down and commence at once to form a scale. The secretion is white and fibrous. In two days the insect becomes invisible, being covered by a pale, grayish-yellow shield, with a projecting nipple at the centre. This nipple is at first white in color. Twelve days after hatching, the first skin is cast. The males at this time are rather larger than the females, and have large purple eyes, while the females have lost their eyes entirely. The legs and antennæ have disappeared in both cases. Six days later the males begin to change to pupæ, while the females have not yet cast the

second skin. At this time the females are so tightly cemented to the scale that they cannot be moved without crushing. In two or three days more, or twenty to twenty-one days after hatching, the females cast their second skin, which splits around the margin of the body. At twenty-four days the males begin to issue, emerging from their scales, as a general thing at night. At thirty days the females are about full grown, and embryonic young can be seen within their bodies; and at from thirty-three to forty days the larvæ begin to make their appearance.

"These observations were made upon young which were born of over-wintered mothers late in June; but it must be remembered that similar larvæ had been hatching since the middle of May. The period of thirty-eight to forty days may be accepted as the length of time occupied by a single generation; but, while this particular generation came out in the insectary about the 1st of August, the adults of the second generation from the earliest born individuals would have made their appearance toward the end of June. Full grown females which began to give birth to the second generation of young on August 1 were kept in view. Three weeks later they were seen still to contain numerous embryos. Young larvæ were running about, while others of the same generation were in all stages of development. The male scales were fully formed, and some contained mature pupæ. The small trees upon which these insects were colonized the third week in June were almost completely covered with the scale. The larvæ evidently made no effort to crawl away from the tree, and none, in fact, reached the rim of the flower pot. The greatest distance away from the tree at which larvæ were noticed was about two inches. Up to this time the insects had confined themselves almost entirely to the branches, and the leaves were still quite free. The first males of the second generation were noticed on August 27. By September 7, or five weeks and a half after the adult females of the first brood began to give birth to young, some of them were still living and giving birth to occasional young. The majority of them, however, were dead or nearly exhausted, while their first larvæ were almost ready to reproduce. Five days later a few of them were still giving birth to an occasional young, while their offspring were also rapidly reproducing.

"At the rate of development observed, between May 15 and October 15 four generations from the over-wintered females developed. The larvae continued to issue until after the first frost in October, at Washington, and on October 24, at Lewisburg, Pa., the writer saw recently-settled larvæ of not more than five days of age.

"There seem to be five generations in the latitude of Washington. Owing to the method of reproduction, these generations immediately become inextricably confused, and the insect after the middle of June may be found at any time in almost any condition. The females which over-winter have, in the great majority of cases, reached a sufficient degree of maturity to have become impregnated by late issuing males. It seems probable that the male rarely hibernates in any stage, although we received on April 3, from Charlottesville, Va., twigs which carried a few male scales containing males in the pupa state. These probably hibernated as full grown male larvæ. Whether unfertilized females over-winter we are not certain; if they do, these occasional over-wintering males will fertilize them.

"The San José scale differs from all others in the peculiar reddening effect which it produces upon the skin of the fruit and of tender twigs. This very characteristic feature of the insect's work renders it easy to distinguish. Around the margin of each female scale is a circular band of this reddish discoloration, and the cambium layer of a young twig where the scales are massed together frequently becomes deep red or purplish. Small spots on fruit produced by a common fungus *Entomosporium maculatum*, Lev., sometimes so closely resemble the spots made by the scale as to require close examination with a lens. When occurring in winter upon the bark of a twig in large numbers, the scales lie close together, frequently overlapping, and are at such times difficult to distinguish without a magnifying glass. The general appearance which they present is of a grayish, very slightly roughened, scurfy deposit. The rich natural reddish color of the twigs of peach and apple is quite obscured when these trees are thickly infested, and they have then every appear-

ance of being thickly coated with lime or ashes. Even without a magnifying glass, however, their presence can be readily noted if the twig be scraped with the finger nail, when a yellowish, oily, liquid will appear, resulting from the crushing of the bodies of the insects."

The female scale is flat, almost circular in outline, dark mottled with gray color, with a small elevated spot at or near its centre which is black or yellowish; it measures about one sixteenth of an inch in diameter, but under favorable conditions may attain to the size of one-eighth of an inch. The fully developed female can only be observed by removing the scale with which it is covered at a time when she is just about to give birth to her young. She will have then lost both her legs and antennæ, being now only provided with a long delicate proboscis consisting of four thread-like bristles encased in a two jointed sheath. The body is almost transparent, and the young can be clearly distinguished within.

The male scale is black and somewhat elongated when fully formed. It is often oval in shape, smaller than the female, and more abundant. The larval skin is covered with a secretion, and its position is indicated by a single nipple-like elevation between the centre and anterior margin of the scale. The fully developed male only has wings. The body is of a light amber color with dark brownish markings, and terminates in a slender stylet as long as the body. It is, however, too minute to be of interest to any but naturalists, having to be always examined with a microscope.

Such was the pest that was, as we supposed, lurking only along the Pacific coast, with a vast width of mountain and desert lying between it and the fair lands and thrifty orchards of the Mississippi valley and beyond. We did not for a moment dream that the pest had gained a foothold along our eastern coast as well, and was each year being sent into the heart of our land, and even the entomologists were in blissful ignorance of its presence. In 1892, Professor Townsend had reported it at Las Cruces, New Mexico, but that was almost as far off and isolated as California, and we still slept on in our supposed security. Early in August, 1893, there came to the Division of Entomology at the Department of Agriculture at Washington, a small bundle of pear and peach twigs from Charlottesville, Va., the sight of which fairly raised the First Assistant Entomologist, who examined them, out of his chair, for he at once recognized the San José scale. But even yet it was thought to be only an accidental occurrence. Later investigations of another outbreak indicated that the pest had come from a prominent nursery in New Jersey, and on being inspected the insect was found to have become thoroughly established and probably had been for several years, as the trees whereby the insect had been traced to this nursery had been sent out in 1888. I shall here follow a policy that has always appeared to me to be the only just one for an entomologist to follow, and give the name of the nursery, which is that of Mr. John R. Parry, of Parry, New Jersey. This was the first intimation that this firm had of the seriousness of a pest that they failed to recognize, though on referring to their books they found that in 1887 they had ordered from John Rock, of San José, California, a quantity of Kelsey's Japan plum trees, and that these trees had been shipped by Mr Rock's order from the nursery of the Stark Brothers, of Louisiana, Missouri.*

*Mr. Stark, of this firm, made the following explanation at the close of the reading of the paper:—

As Prof. Webster mentions our name, we wish to state the circumstances in full as we now recall them: In 1885, we had the pleasure of visiting the nursery of John Rock, at San José, California. Mr. Rock is well known as one of the principal California nurserymen, and it is needless to say that the visit was interesting, and instructive as well. Among other things particularly noted, was his method of treating trees before shipment to destroy the San José scale. This method he supposed to be entirely effective, and, remembering this, in the spring of '87, the Kelsey plum being then a scarce novelty, we ordered a lot of first-class Kelsey plum trees from Mr. Rock; but as a good many of us have learned "first-class" trees on the Pacific coast mean a very different thing from first-class trees in the east. On the coast, it seems they sometimes go into rows of one year trees and dig about everything clean that is thrifty and two or three feet in height, or even less; so when the trees arrived and the lid was removed from the box, showing one year trees running from about eighteen inches in height upwards, it was apparent we could not accept nor use the grade and we so wired Mr. Rock, who wired in reply to express them to the New Jersey parties, and the trees accordingly were immediately expressed to Messrs. Parry and to J. T. Lovett, thus quickly removing every one of these Kelsey trees from our grounds—a most fortunate circumstance for us, as it has since appeared.

The Parry people were as much astounded at the revelation as were the Government Entomologists, and promptly destroyed over $1,000 worth of stock, and as promptly stopped shipping anything from their nursery, buying from localities that are even now beyond the area of infection, the trees whereby to fill their orders. From this time on this firm has followed this policy and bent their whole efforts on stamping out the pest on their premises, sparing no expense in the accomplishment of their purpose. I cannot myself find words to express my own commendation of the course of this firm, and I do not believe that the American people will overlook or underestimate the public spirited acts of the Messrs. Parry. Had all of those who are engaged in your vocation, and were similiarly unfortunate, followed this course, the entomologist and the agricultural press might have been spared the unenviable task of exposing their disgrace. The introduction of the San José scale from California was a sad piece of carelessness on the part of at least four firms of nurserymen, as either one, had they applied to the Department of Agriculture, might have learned and avoided the danger, as the Division of Entomology had, at the time the introduction took place, two of its special field agents in California, and would most certainly have pointed out the danger had an opportunity been presented. Up to the time that the proprietors were notified of the presence of the pest, then, carelessness only can be charged against them, and they should be judged according to their acts since that time. The Parry Brothers, when the pest was found established on their premises, asked that the fact be withheld from publication, as it would otherwise ruin their business. Considering the efforts being made by them, it was certainly no more than just to give them an opportunity to show what they could and would do, and as we yet have no reason to suspect that they have betrayed the confidence placed in them by the Government and State Entomologists, and, besides, they have willingly furnished entomologists with a list of purchasers who were liable to have received the pest with trees sold from their nursery, prior to this discovery of its presence among their nursery stock. What more could they have done to undo the wrong, or prevent its continuation?

Soon after the foregoing outbreaks of this pest had been investigated, another badly infested nursery was located in New Jersey, that of the Lovett Company, at Little Silver, and which, as we now know, was infected in precisely the same way and at the same time as the first. This nursery was known to be infested as early as September, 1894, when it was visited by the entomologist of the Experiment Station of that State, and the fact pointed out to the officers of the company, who promised to destroy and disinfect their trees before sending them out to their customers. The New Jersey entomologist took upon himself the responsibility of stating in public print that these precautions were being taken, and that everything possible was being done by the company, whose name he did not give, probably supposing that he was dealing with men who would readily see that their own interest would lead to such a course, and was not as active in holding them to their promise as he would have been justified in doing. It was late in December—over three months later—that I received twigs of apple infested by this scale from Clermont county, Ohio, and on promptly visiting the orchard found some twenty-five trees literally covered with the pest, and three times as many more infested to a large degree, but all in such a condition that sixty of them have since been dug up and burned. These trees had been purchased from the Lovett Company and planted out in spring of 1890. In a note given to the daily press on the discovery of this serious outbreak, I stated the fact that the trees had been purchased from this firm, but did not accuse them of having, at that time, the scale among their trees, though the fact was not unknown to me. Promptly on the appearance of my note came a letter to the Director of the Ohio Experiment Station, which ran as follows:

LITTLE SILVER, N.J., December 28, 1894.

Director Experiment Station, Columbus, Ohio:

DEAR SIR,—One of our customers has sent us a clipping from a Columbus paper, in which is stated that trees owned by one Mr Nicolis have been found infested with the San José scale. You will please give us all the information you can in regard to this matter. We would like very much, indeed, to have some branches from the trees referred to for examination ourselves. We have made a critical examination of our trees here in the nursery and also fruiting trees, using the miscroscope, and can find no trace whatever upon any of them of the San José or other scale. Having read reports upon the San José scale, we are confident that we could detect this insect if it existed upon our trees.

Yours truly,

(Signed) THE LOVETT COMPANY. H.

Now here was a serious state of affairs indeed. An official entomologist, whom I had known for years, had given the information, and here was a firm assuming their innocence, and being compelled to go over a whole nursery with a microscope, in fruitless search after the San José scale. Gentlemen, did any of you ever attempt to go over a tree with a microscope? And do you remember how much time it required to accomplish the task; how tiresome it was and how weary you were long before you had finished? Yet here were men compelled to go over a whole nursery, because of an unjust accusation. I promptly sent a copy of the letter of the Lovett people to the New Jersey Experiment Station and asked them to explain the matter. They were able to explain everything except the conduct of the firm, but at that were as much astounded as I was, and again reiterated the statement in regard to the examination with the President and Secretary of the company the preceding September. A month later, in February of the present year, Dr. Lintner, State Entomologist of New York, asked them to furnish a list of their sales in his State—such as had been freely and gladly done by the Parry Brothers—explaining at the time its character and the value it would possess in undoing the wrong that they had unintentionally done. After much delay and dickering, the Entomologist of the New Jersey Station received the following modest proposition: "If he (Prof. Lintner) will send us, or you either, a remittance of $250, we will attempt to make the examination desired. But we want a clear understanding before we begin as to the settlement of cost of sending the list he requires." I need hardly say that the money was never sent for there is little doubt but that the list would have been as "scaley" as their trees. Public indignation, however, had been rapidly increasing, and on February 22nd, the Entomologist of the Experiment Station accompanied by a member of the editorial staff of the Rural New Yorker, paid this nursery a visit of investigation, and found that while some more or less effective means had been employed to destroy the scale, there was ample evidence of a carelessness that in many countries would have been considered criminal and cost the firm their plant, if, indeed, imprisonment were not added. I can only repeat here what I said of the action of the first-mentioned firm: it will be a long time before the people will forget these things, and all statements of the Lovett Company will be taken on probation, which probation will, if I mistake not, be a protracted one.

Even while the foregoing developments were proceeding, we became aware that there was another locality of distribution of this pest; viz, Long Island, N.Y.; and it was toward this part of his State that Dr. J. A. Lintner, State Entomologist, turned his attention, with the hope of protecting his people from having the scale distributed among their orchards and farms by Long Island nurserymen.

Dr. Lintner was only faithfully carrying out the duties of his office, and went about doing that duty in a moderate, conscientious manner, that ought to have received the unqualified support of every fruit grower and nurseryman in his State. But he soon found that he had the same diversity of character to deal with as had been revealed in New Jersey. Of the nine nurseries located on the island, but three were found to have become infested, and these, as given in a recent bulletin from the New York State Museum (Vol. 3, No. 13) are owned and operated by Fred. Boulon, Sea Cliff; Keene & Foulk, Bloodgood Nursery, Flushing; and Parsons & Son, also of Flushing. The first named, though moving in a somewhat dilatory way, finally destroyed his worst infested trees and sprayed so that it is hoped that no infested stock will be distributed. Of the actions taken by the second named firm, Dr. Lintner, in his bulletin above referred to, speaks in terms of highest praise. As soon as this firm learned of the presence of the scale on their premises they promptly burned the worst infested trees and sprayed the remainder, besides asking for instructions and directions in regard to methods of suppression, they have promptly carried out every one of these, making every effort possible to protect their customers, offering on request to replace at half price all trees sold from their nursery, during previous years, that were found infested by the San José scale. There seems to be no reason why this firm should not continue to enjoy the confidence and patronage of the public. The last firm mentioned, Messrs Parsons & Sons, chose an opposite course, and I may add, deserve opposite treatment. From the first,

this firm paid no attention whatever to the evil, when it was pointed out to them, and when asked to disinfect their stock before shipping it to their customers, stated that they would if they had time; and, later, said they did not have time. There is very strong evidence in the hands of entomologists going to show that this firm made both their last fall and spring shipments, knowing that they were unloading their scale infested trees on the public and scattering this pest, the serious nature of which they could not help knowing, far and wide over the country. Failing in every attempt to secure satisfactory replies to his communications, or even a list of the patrons who were likely to suffer from their impositions, and after your humble servant had pointed out to him that he was only being imposed upon and his moderation toward this firm only being used to further their scheme of unloading their infested trees on the unsuspecting public, that he was forced to call upon the "Rural New Yorker" to expose them. In the issue of that publication for May 4, 1895, the editors, after exposing the Parsons Company, say that the Company made a plea of ignorance of the serious nature of the pest, and supposed it was only one of the many scales that they had known for the last fifty years. No wonder that the "Rural New Yorker" people were boiling over with indignation over a course that was alike unprincipled and un-American, and ask why it was necessary for them to come forward and make business men attend to their duty, telling the company that it was no excuse at all for them to plead ignorance of the dangerous character of the pest and neglect the repeated warnings that have been given. To plead ignorance was a direct insult to State Entomologist Lintner, who had again and again warned them of it and urged them to take immediate steps to prevent distributing it all over the country. These people now, after being publicly exposed, promise to do all in their power to prevent sending out infested stock, and if the public deal with them as they deserve, it will be some time before they will distribute their trees at all, for who will expect them to keep any promise after such evasions as they have attempted? If the entomologists and the press are not again called upon to expose them a second time, it will be a pleasant surprise.

Now, gentlemen, I have criticised harshly, but I sincerely believe not unjustly. I have exposed these people before you, not in order to taunt you with the disgrace of some who follow your calling, but because they threaten interests of yours that I am employed to protect. It is my business and duty to do so. You do not need to deal with these people yourselves to suffer contamination. Let me explain, and this I will do by illustration. Last winter a man came to me in high dudgeon and wanted me to show up a prominent firm of nurserymen in Ohio. He said that he had gone to them in the fall to buy trees. He did not appear to care much what the trees were so long as they were fruit trees and cheap. He said that he had gone to this nursery and found what he thought would answer his purpose, provided the price was right. The trees were poor and expected the price to correspond, "but do you believe," he said, "them galoots wouldn't sell me them trees at any price and said they were going to burn them up, I suppose just to make me pay a big price for others. But I won't do it. I'll buy where I can get what I want and at a reasonable price of eastern nurseries." Now, we all know what sort of a fruit grower such a man would make. One of the sort that sets out his trees and then lets the pigs, cattle, sheep and horses take care of them, and who, if he were to buy scale-infested trees would not find it out until the whole neighborhood was endangered. Suppose such a man buys scale-infested trees and plants them out in your neighborhood, thereby threatening your business, what will you do about it? If he furnishes scale enough to destroy a thousand dollars worth of your stock and ruin your trade for several years, you cannot help yourselves, in the present condition of our laws. You cannot reach the man who sold the trees, and to destroy them on your neighbor's premises without his permission, is to criminate yourself. I have no fears of the pushing, up-to-date fruit grower or the honorable nurseryman, for if they have the misfortune to get this pest, they will stamp it out without compulsion. But I am afraid of the nurseryman who will knowingly or carelessly distribute this pest to careless or indifferent purchasers; and this is precisely where we entomologists are

expected to protect you. In order to protect the people of Ohio, I have felt from the start that it was necessary to first prevent this pest being continually shipped in from infested nurseries, and then use every means to find out infested localities and stamp it out. This is the only way that I can protect the people of my State, both nurserymen and fruit-growers. What is true of Ohio is true in other States, and of other entomologists.

It seems to me that what we need is a United States law, that shall apply equally well in every State in the Union, that will enable those nurserymen who wish to do so, to send their authorized agents into any State to do business, each firm being thus responsible for the acts of their agents. If nurseries desire to sell stock in States other than their own, or the people desire to purchase such stock, they should have legal protection. Then let every nurseryman be obliged to warrant his stock free from insect or fungus pests before transportation companies can accept the same for shipments. This will do away both with the disreputable nurseryman and the tree-peddler, and place your business in the hands of honorable men. You may think it an objection, and possibly a hardship to thus be obliged to guarantee your stock free from these pests, but I fully believe it is precisely what you are coming to and of your own accord. I am fully convinced that within the next ten years every reputable nurseryman will spray his nursery stock several times each year with both insecticides and fungicides, not because he is obliged by law to do so, but because it will pay him well for the extra time and expense. We are beginning to learn that the apple scab begins to weaken the vitality of a tree from the first year onward, and the same is true to some extent with insect pests, that by spraying the nursery rows you can produce a greater number of first class trees to the acre, and so derive a larger profit from your land and the labor bestowed upon it. Now, this is only a suggestion whereby this problem of distributing such pests as the one under consideration can be prevented, at little or no real expense, and those more competent than myself can no doubt improve on the suggestion, and you will readily see that when another case like this comes up, and a nursery is found to be infested the owner has only to purchase his stock for a year or so of his more fortunate neighbor, until he can cleanse his premises and use his product. This will also do away with an injustice that I have seen all along, and, in fact, been obliged to, myself, make use of. I stated at the beginning of this paper that it was but right to give a reputable firm time in which to show what they would do to protect their customers, but it is a rank injustice to others of his profession to publish the fact of the occurrence of such a pest as this in a certain locality or State, and not give names in connection with such information. I am bitterly opposed to the policy that I have been obliged to follow during the last year, knowing, as everyone must, that to quarantine against areas instead of individuals, must work an injustice upon the very ones that are the most deserving of justice. When the word goes forth that this pest is in a certain State and liable to be distributed from it to others, the only protection for the others is to stop all shipments from the whole State, when there may be but a single nursery infested. This is the rankest kind of injustice, and I hope some measures will be devised to prevent a recurrence of such a condition of affairs as we have had with regard to the suppression of the San José scale. I have been obliged to warn the people of Ohio against New Jersey and Long Island, when I knew it was a wrong to the very men that I was trying to help, simply because I could not get the names of the guilty ones, and indicate them to our people. I hope, gentlemen, before you adjourn from your deliberations, you will take some action not only denouncing the course taken by the two nursery firms that I have named, but indicating some policy whereby this problem can be met in a judicious and at the same time thoroughly efficient manner. The San José scale is the latest importation, so far as we know, but it is not at all likely to be the last. Our commercial relations with other countries are not only increasing rapidly and broadening, but the time required for transporting your goods from place to place has been diminishing much more rapidly. It is now possible to remove plants from their native homes in Australia, South Africa, Europe or Asia, and in the short space of a month's time scatter them over the whole country. Destructive insects may thus go into their dormant stage in one country and

emerge in another without having been disturbed or discommoded, something that would have been impossible twenty five years ago. With such strides, such progress in these factors in your business, it will be absolutely necessary for you to bring your business methods up to date, and change to meet your changed conditions. By necessity, you are foremost in the diffusion of these pests of your trees and plants, and it would appear to naturally follow that you should be foremost in taking steps to prevent this diffusion—should lead instead of follow—and I hope you may begin to recognize the situation, and with past experience to guide you, look into the future and prepare to meet these emergencies and overcome them.

Returning for a moment to the San José scale, before closing, I will say that the insect does not appear to spread rapidly, at least not at the start, and is not so difficult to overcome, if given prompt and careful attention. At present it would seem as though it might be wholly eradicated from the orchard or nursery within a year after being discovered. Whale-oil soap, one pound to each gallon of water, makes a wash that is most fatal in its effects, when applied during autumn and again just before the buds start in the spring, followed by a similar treatment in autumn. The use of hydro-cyanic acid gas is thoroughly effective, and though rather expensive to use in an orchard, is not so much so where trees can be treated in bundles. Full instructions for using this may be had on application to the United States Department of Agriculture at Washington. It is true that this scale is now established at several points in most of the States east of the Mississippi river, but I am satisfied that all such can be stamped out, provided proper attention is given the matter now while it is yet confined to the orchards into which it was originally introduced. For the present this is the only protection that the nurseryman and orchardist have against this pest, or rather, I might say, against a disreputable fellow of his calling, or a shiftless neighbor; and I would caution you all to keep close watch of orchards in your respective neighborhoods, especially such as have been planted out within the last five years with other than home-grown trees. I find that in some quarters there is a disinclination to let the matter of infection become known. So far as the farmer and orchardist is concerned this is folly, as to have acquired this pest is no disgrace, but a misfortune, and I find that the statement that it has been discovered in a certain locality and promptly eradicated, is an incentive for others to look more closely to their trees and, in case the scale is found, follow the example of their neighbors.

In closing, I wish to call the attention of nurserymen to the fact that the entomologist is working for their interests, both in the matter of protecting them from getting such pests established in their nurseries, and aiding them to get rid of them in case they have been unfortunate enough to have done this. To prevent sending out infested trees from any nursery is a part of the duty of an entomologist, however disagreeable it may be to do so. So long as men are human, it will be necessary to resort to disagreeable methods of preventing them from wronging each other, and the best that can be done is to deal with strict justice toward all.

At the conclusion of Prof. Webster's paper, the following appreciative motion was put to the meeting and carried unanimously:

Col. WATROUS: "I think that the paper that comes out and deals with our interests as fairly and as wisely and intelligently as this one deserves a vote of thanks, and I move that a vote of thanks of this Association be tendered Prof. Webster for his paper and that we approve his course."

THE CHAIR: If any of you have any questions to ask of Prof. Webster, he will be happy to answer them; or if any of you have any statements to make we shall be glad to hear them. It is certainly the most interesting subject that could come up in a convention, for it is a matter of dollars and cents for us.

Col. WATROUS asked what would be the proper course to pursue should a nurseryman be so unfortunate as to receive a bundle of trees from another nurseryman which were found to be infested by this pernicious insect.

Prof. WEBSTER: Send them back to the original nursery.

Col. WATROUS inquired further if there were any way by which the insects could be killed on imported stock so that it would be safe to plant the trees and propagate from them. I want to know if it is absolutely necessary that they be burned or reshipped.

Prof. WEBSTER: They could be disinfected by using hydrocyanic acid gas, the management of which you can get by applying to the Department of Agriculture at Washington. It is a very expensive treatment.* One receiving infested stock, if he did not send them back, could hold the trees at the order of the shipper. I do not see that the nurseryman should be called upon to take them at all or to take the responsibility and expense of disinfecting them.

Mr. JEWETT asked what had been done in California. I have heard that they have exterminated it in some localities.

Prof. WEBSTER: They have practically exterminated it in some localities; but they seem to have handled it very carelessly, and it may be said to cover the whole state more or less. They have used the lime, salt and sulphur wash. This has not been fully effective, and further than that we have found in the East that a treatment of great value in California is not so here. They have a resin wash there which it is claimed is fatal. With us it will not kill twenty-five per cent.

A MEMBER asked if there was danger of the San José Scale spreading rapidly unless infested trees were taken up.

Prof. WEBSTER: It is not the travelling of the insect itself, the spread in that way is not rapid; but it may be carried by the wind or by the young insects crawling on to birds which frequent the trees and being by them carried to other trees—so that it is dangerous to have it anywhere. It does not spread very rapidly, and if carefully sprayed it can be controlled and even stamped out. There are four or five places where I know it has been stamped out in Ohio. I would take up and burn any very badly infested trees.

A MEMBER: Could the Scale be carried from California on fruit shipped to us.

Prof. WEBSTER: Yes, it is carried all over the East; but how great the danger may be I do not know. The greater part of the fruit is consumed in towns and cities, and unless the infested fruit is thrown down so close to the trees that the young insects can make their way from the waste peeling to the tree, then there is no danger. I do not look upon this as a serious feature of the case, although it would be well to watch it.

LEPIDOPTEROUS PESTS OF THE MEADOW AND THE LAWN.

BY THE REV. THOMAS W. FYLES, F.L.S,, SOUTH QUEBEC.

I very much doubt whether I shall ever see again what was no uncommon sight on the older farms in the "flats" and "intervales" of Brome, Shefford and Missisquoi counties thirty years ago, viz.:—a field of Herd's grass *Phleum pratense*, L.), clean and tall, unspecked with Ox-eye (*Leucanthemum vulgare*, Lam), Cone-flower (*Rudbeckia hirta*, L.), and Charlock (*Sinapis arvensis*, L.).

I perfectly remember the first appearance of the Ox-eye daisy in Brome. A hot, dry season or two had made a scarcity of fodder, and men had gone down to the "French country" around St. Cesaire, St. Pie and St. Marie to buy hay. In the spring, a year or two years afterwards, an old-country farmer, Mr. Terence Courtney, of Iron Hill, pointed out to me, here and there by the wayside, along the line of travel, tufts of "the daisy" which had no doubt grown from seeds shaken from the loads brought in from the low country. He cut up those on his own farm, but his neighbors were not so careful, and now, in hay time, all the meadows round are white with the troublesome weed.

* NOTE.—It has since been discovered that this treatment is not effective against the San José Scale unless applied for a longer time than can safely be done without injuring the trees treated. Dr. Howard, in a recent publication, "Some Scale Insects of the Orchard," says: "With the San José Scale the most satisfactory work can be done only with a winter wash." . . . "Up to the present writing, but one absolutely satisfactory winter wash against this insect in this locality has been found. This is whale-oil soap, a pound and a half or two pounds to the gallon of water."—J. Fletcher.

In those days there was much clearing of land on the hillsides and burning of brush heaps and log-piles, and the frequent fires and eddying smoke kept down the numbers of the insect pests of the meadow and the lawn.

The arable land, on which hardwood timber had formerly grown and which was free from stumps, was, in many districts, comparatively of small extent and was well worked. On the newly burnt land Indian corn, turnips and potatoes were grown for a season or two, and then Herd's grass seed was freely scattered to convert it into pasture.

In the neighborhood of South Quebec we have at the present day much slovenly farming. Last June I noticed a meadow in which the grass stood tall and rank and uniform, but it was a meadow of Couch (*Triticum repens*, L.). A meadow golden with that very handsome but most objectionable plant, the Hawkweed (*Hieracium Canadense*, Michx.), or blue with the Succory (*Cichorium intybus*, L.) is often seen. A really good meadow of Herd's grass or clover is not common, and what an Englishman would call a fine lawn is hardly to be found in the province. The moist, salt air of the old country seems to be necessary to bring a lawn into perfect condition. It is not my present purpose to to tell of the agricultural remedies for this state of things. I have alluded to it because I wish to say that good tillage has a decided tendency to keep down the numbers of pernicious insects, and that in a well-considered and worked out succession of crops the meadow is likely to thrive. Fall plowing will expose many grubs and pupæ to the attacks of birds and the action of the frost; and cross-ploughing in the spring will give the birds further opportunities that they will be sure to profit by. The occasional removal of rail fences and the rooting out of the growth that springs up about them, will destroy the harbourage of numerous foes; and frequent mowing and the free use of the roller will not only beautify the lawn but crush out of existence many of its insect spoilers.

Of the Lepidoptera certain groups are especially *gramini vorous*. They belong to t *Satyrinæ* and the *Hesperidæ* in the *Rhopalocera*; the *Ctenuchidæ*, the *Arctiidæ*, and the *Noctuidæ* in the *Heterocera*; and the *Crambidæ* in the *Pyralidina*.

Satyrinæ

The Quebec Satyrinæ are :—*Debis Portlandia*, Fabr., *Neonympha Canthus*, Bd.-Lec., *Neonympha Eurytris*, Fabr., *Satyrus Nephele*, Kirby, *Chionobas Jutta*, Hübner.

The most common of them is *Satyrus Nephele*, Kirby, "The dull-eyed Grayling." It appears in July, and frequents the open fields and the borders of woods and copses. Around Montreal it is abundant, in its season, on thistle heads, in neglected spots.

It is brown, with a broad paler brown band near the outer edge of the fore-wings. In this band are two conspicuous eye-like spots. These consist of a bluish white central spot, surrounded by a black circle and a very pale outer circle. The under side of the wings has numerous dark brown cross markings. It lays its eggs in August, and the young larvæ hibernate in the first stage.

In colour the full grown larva is yellowish green, with a dark green dorsal line and a yellow stigmatic line. It has a reddish fork at the extremity of the body.

Neonympha Canthus (Fig. 85) is smaller than *Nephele*, and is of a light sandy brown. Its spots are more numerous, and each spot on the under side of the hind wings has *two* pale rings around the black one. Note.—*At the anal angle there are twin spots close together and thus encircled.* Canthus frequents upland meadows, and appears in July. The female lays her eggs in the end of that month.

Fig. 85.

The larva is green, with darker green and yellow longitudinal lines, and it has cephalic and terminal horns. It hibernates in the last stage of its growth.

But a more hurtful, because more numerous, group of grass feeders are to be found among the

HESPERIDÆ.

They belong to the genus Pamphila in the Hesperidæ, and are commonly called "Skippers (Fig. 86). The most common of the Quebec species are :—*Pamphila Hobomok*, Harris; *P. Manitoba*, Scudder; *P. Peckius*, Kirby; *P. Mystic*, Scudder, and *P. Cernes*, Edwards. The three last may be seen in June and July scudding about the meadows in droves.

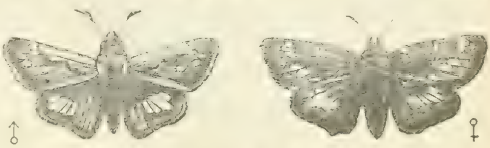


FIG. 86.

Mr. W. Saunders, of London, Ontario, succeeded in raising *P. Mystic* from the egg to the pupa, and has described the changes of the larva in the *Canadian Entomologist*, Vol. I., p. 65. The larva was full-grown in August. It was an inch long, onisciform, downy, with a dull reddish-brown head and a dull brownish-green body. It had many dots of a darker hue and a dark dorsal line. The second segment was whitish with a dark line across the upper surface.

Mr. Fletcher, of Ottawa, raised *P. Cernes* from the egg to the pupa. The eggs were laid on grass on the 10th of July, and hatched on the 23rd of that month. The larva was full grown in September. It was an inch long, of a purplish-brown color, mottled with grey and dark purplish-brown, and it was covered with fine, short, black hairs. It had a black head and a thoracic shield on a white collar. The spiracles were black.

Both *Mystic* and *Cernes* hibernate in the chrysalis.

P. Metacomet, Harris, hibernates as a larva (Fletcher, *25th Rep. Ent. Soc. Ont.*, p. 4).

P. Manitoba, Scudder, spends eight months, or two-thirds of its existence, in the egg. The young larvæ appear in April and are full grown in July. The butterflies come forth in August, and lay their eggs in the same month. For the life history of the species see *Canadian Entomologist*, Vol. XXVII., p. 346.

CTENUCHIDÆ.

Of this family two species are common at Quebec, *Scepsis fulvicollis*, Hubner, and *Ctenucha virginica*.

The imago of *S. fulvicollis* appears in the beginning of June. Its expanse of wings is about an inch and two-tenths. Its head and body are of a deep velvety purple. The antennæ are pectinated in the male, and dentated in the female. The striking feature in the insect is the broad yellow collar from which it derives its specific name. The fore-wings are of a somewhat bronzy black with the costa obscurely yellow. The secondaries are semi-transparent with black veins, and with the inner and hind margins clouded with purplish black.

The full-grown larva of this species is one inch long. Its head is glossy yellow, and its body is slate colored, striped with green, pink and pale yellow, and it has a number of small warts set with white hairs. At the end of July or the beginning of August it spins its cocoon.

Ctenucha virginica, in general appearance, resembles *Fulvicollis*, but it is a larger insect; its expanse of wings is an inch and a half. The secondaries are of a deep blue-black, with whitish edges.

The larva of this species, when full-grown, forms a cocoon of the spinulated hairs from its body; it plucks them out and arranges them, and they adhere firmly in the required shape. (*Packard's Guide*, p. 239.)

ARCTIIDÆ.

The Arctian larvæ that have been found injurious to the meadows are chiefly those of *Pyrrharctia Isabella*, Smith and Abbott, and *Leucarctia acræa*, Drury; both are well known. The former is that brush-like caterpillar, Fig. 87 *a*, black at the ends and chestnut red in the middle, that so often is found under boards and in out-buildings late in the fall and in the early spring. When disturbed, it rolls itself up hedge-hog fashion. It forms its cocoon, Fig. 87 *b*, in May, and the perfect insect, Fig. 87 *c*, appears in June. This last is two inches and a quarter in expanse of wings. Its colour is yellow, with indistinct wavy lines on the primaries and with dark brown spots on all the wings, and also on the abdomen. The secondaries are sometimes tinged with red.

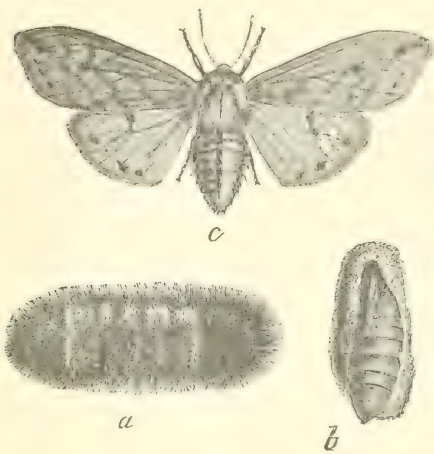


Fig. 87.

The larva of *L. acræa* is the "salt-marsh caterpillar," the ravages of which have been so well described by Harris in his *Insects Injurious to Vegetation*, pp. 351-355. It is about an inch and three-quarters in length and is clothed with long hairs, which are dark brown on the back and lighter brown on the sides Its spiracles are white. This caterpillar appears in June and attains its growth in the end of August, when it spins its cocoon. Of late years the numbers of the "Woolly Bears," as they are commonly called, have been greatly reduced by a fungus which spreads among them and destroys their vitality.

NOCTUIDÆ.

The Noctuids are the night-flying or owlet moths. Their name is derived from the Latin *Noctua*, an owl. These moths, on warm, moist evenings, often beat at the windows of our country houses, attracted by the light. In dress they are a sober "people"—browns and drabs prevail amongst them. But innocent as they are in appearance, they, through their larvæ, work incalculable harm. Amongst these larvæ are the various species commonly classed as "cut-worms." Amongst them, too, is the dreaded "army worm."

Of the cut-worms, one that has been particularly marked as injurious to the hay crop is *Peridroma saucia*, Hübner. Of this there are two broods in the year (*Lintner's 5th Report*, p. 64). The eggs of the first hatch in the beginning of May, and the larvæ attain their grown in the beginning of June. The full grown caterpillar is about an inch and a half long. It is of a dirty greyish brown, with spots and markings of yellow and dark brown. The moth leaves the chrysalis in about twenty days, *i.e.*, in the end of June. It is an insect of considerable size, the wings expanding about an inch and three-quarters. Its colour is brownish or ochreous grey, clouded and spotted with brown and with stigmata outlined with brown. The second brood appears in the fall.

Nothing in the vegetable line seems to come amiss to the caterpillars of this species. In the meadows they strip the clover and cut off the heads of the timothy; and even the roots of the grasses are devoured by them.

The larva of *Noctua fennica*, Tausch, is another of the grass eating cut-worms. When full-grown it is about an inch and a quarter long. In colour it is velvety black, with two irregular and broken yellowish stripes on each side. Its head is brown, with a black stripe down the front, and it has a black, horny shield on the second segment. In May, 1884, Mr. Fletcher found it exceedingly destructive in meadows around Ottawa; and in the same year it abounded in the meadows of Michigan to such an extent that, to use the words of Professor Cook, of the Agricultural College of that State: "There were meadows through which one could not walk without crushing from a dozen to a hundred at each step."

The moth is not quite as large as *P. saucia.* Its head and thorax are dark brown; the fore-wings are dark brownish grey, with a purple blush; the stigmata are clay-yellow. The renal stigma often takes the form of the letter R; near the hind margin are two small, angulated, black marks.

Another very mischievous insect of the kind we are considering is the "glassy cut-worm," *Hadena devastatrix*, Brace. It bites away the roots in the sod till the grass comes off in patches. I have seen considerable spots in the pastures and meadows of Brome laid bare by this pest.

The eggs of the species hatch early in May; and the larvæ attain their growth in about four weeks. They are glossy green in colour, with the head red, and the thoracic shield dark brown.

The moth has dark ash-grey fore-wings, with several white lines across them and some angulated black spots near the hind margin. The stigmata are black, outlined with white.

These cut-worms have been very destructive to meadows in the past, and may be again; and it is possible that other species may become so.

Another group of the noctuidæ injurious to meadows belongs to the genus *Leucania.* A very common species in the group is *Leucania pallens*, Linn., the "Wainscot moth." It may be known by its sandy fore-wings finely lined with a little darker colour, and by the three tiny black dots arranged in a triangle beyond the middle of the wing. It has white satiny hind-wings with a few brown streaks.

Leucania Henrici, Grote has dull white fore-wings with pale brown streaks. It has no black dots, and the hind-wings are clear satiny white.

Leucania commoides, Gn. is a much darker species, and may be known by the white line in the middle of the fore-wing thrown out by dark brown on either side, and branching into white lines with dark brown streaks between them. The hind-wings are dark with dark brown veins.

Leucania albilinea, Hubner is the smallest of the Canadian species known to me. It is not so dark as *commoides*, and the white central streak is branchless. This streak is thrown out by a brown one on the inner side, and, on the outer, by another which widens as it approaches the hind margin where it spreads on both sides. There is also a paler brown stripe along the costa. The secondaries are clouded towards the hind margins and have brown veins. Fig. 89 represents the eggs much magnified, and the caterpillars on an ear of wheat.

Fig. 88.

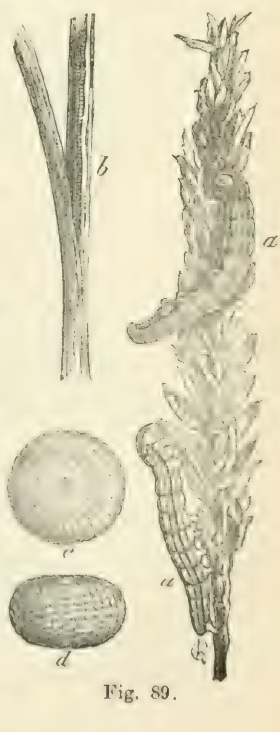


Fig. 89.

The two largest of our Quebec Leucanians are *L. unipuncta* Harv. (the Army-worm moth), and *L. pseudargyria* Guen. They somewhat resemble each other, but *Unipuncta* is of a pale reddish brown, or russet hue. *Pseudargyria* is of the tint known in the old country as "whity-brown." Moreover *Unipuncta* has a small but conspicuous milk-white dot in the middle of the fore-wing—hence its name. In place of it Pseudargyria has a pale circle, sometimes imperfect, enclosing a black dot.

When I went to live in Montreal in 1861, ("the Army-worm year"), I noticed, on the Cote-des-Neiges' road, on the wall enclosing the "Priests' Farm," a broad black line, about two feet from the ground, extending the whole length of the wall. I found it was of tar; and, on enquiring as to its purpose, I was told that it was intended to stop the Army-worm in its march from the mountain.

L unipuncta the One-spotted Leucanian lays its small,

round, white eggs at the base of the stems and within the folds of the blades of grass. They hatch in eight or ten days, making their appearance in May. In a month the larva is full grown. It is dull black lined with with white, yellow, and pink. It buries itself, forms a cist, and then turns to a mahogany brown chrysalis. The moth appears in about a fortnight.

The Army-worm in its strength is indeed a formidable foe—"The land is as the garden of Eden before it, but behind it a desolate wilderness." A correspondent of the *American Entomologist* told of the creatures coming down upon his lands in a phalanx half-a-mile wide.

Happily for the farmer there are two powerful natural checks to the increase of these troublesome pests; and often when he is at his wit's end *they* are most effective in his service. One is a fungus which spreads from larva to larva and speedily paralyzes and consumes them: the other is the Red-tailed Tachina fly, *Nemoræa leucaniæ*, Kirkpatrick, which lays its eggs upon the living larva in parts where it cannot dislodge them. The maggots that burst from the eggs destroy their victims by thousands.

Crambidæ.

A very elegant, but very mischievous group of moths are the Crambidæ or "Grass moths," of which we have many species. Their larvæ form silken tunnels at the roots of grasses and work unseen. Their retiring habits make it difficult to follow them in their career; and but little is known of the life histories of most of the species. Dr. Lintner has given us a good account of *C. vulgivagellus*; and other writers have afforded us glimpses of a few of the rest. In the dearth of information the following particulars concerning *C. Girardellus* may be of interest.

Notes on Crambus Girardellus.

Eggs.—Laid dispersedly, pale yellow, melon-shaped, ribbed and cross-lined; hatched the first week in August.

Young larva.—One-twentieth of an inch long; head and second segment dark brown, rest of body amber coloured; formed dirty silken tunnels at the roots of the grass; moulted August 20th.

Larva after first moult.—Length, one-sixth of an inch; head and horny plate on second segment dark brown, polished; body pale amber beautifully spotted with sienna-coloured warts, and sparingly set with bristles; moulted September 1st.

Larva after second moult.—Head of a dirty amber colour, marked with brown patches; body amber-coloured, dotted with large brown tubercles.

At this stage I lost my specimens—the frequent disturbances necessary to the observation of their habits proving destructive to them.

The following is a table of the Quebec specimens of this interesting group:

Characteristics of the Group.

Antennæ filiform; labial palpi long and beak-like, porrected; wings in repose folded round the body; fore-wing usually oblong and, in most instances, bluntly terminated, but sometimes, as in *C. minimellus*, with a produced tip. Hind-wings ample.

Larva with sixteen legs; head and thoracic shield usually black or brown; body whitish or straw-coloured, somewhat hairy, and sometimes having glassy tubercles. It forms silken galleries at the roots of grasses.

Table of Species.

A.—*Fore-wings white.*

a. Pure silvery white.
C. perlellus, Scop.

b. Satiny white with several dark brown dots.
C. turbatellus, Walker.

c. Satiny white with a reddish brown dot in the middle of the inner margin, and a reddish brown terminal line.
Argyria nivalis, Drury.

d. Satiny white with an orange band across the wing.
A. auratella, Clemens.

e. Satiny white, with a longitudinal orange stripe bordered with brown and widened into a foot near the hind margin.
C. Girardellus, Clem.

f. White with brown patches and cross-lines.
C. elegans, Clem.

B.—*Fore-wings golden.*

g. Golden with a silvery stripe running throughout and widened at the hind margin.
C. unistriatellus, Packard.

h. Golden with a silvery stripe ending in a point near the sub-terminal line.
C. Leachellus, Zincken.

i. Golden with a very broad silvery stripe ending in a point and having a conspicuous tooth on the inner side.
C. bidens, Zeller.

C.—*Fore-wings ochreous.*

j. Brownish ochreous, with a short, broad and pointed, silvery dash followed by a silvery stroke.
C. alboclavellus, Zeller.

k. Pale ochreous, with a silvery dash divided by a yellow streak.
C. agitatellus, Clemens.

l. Ochreous, with two silvery parallel streaks, the second longer than the first.
C. laqueatellus, Clemens.

m. Pale ochreous, with brown lines and an angulated silvery line bordered with brown near the hind margin.
C. hortuellus, Hübner.

n. Pale ochreous, with fuscous longitudinal lines, and two fuscous transverse curved lines.
C. ruricolellus, Zeller.

o. Pale brownish ochreous with brown lines and two darker brown transverse curved lines.
C. trisectus, Walker.

p. Reddish ochreous with two wavy, somewhat indistinct cross-lines.
C. luteolellus, Clemens.

q. Brownish ochreous with numerous brown streaks.
C. vulgivagellus, Clemens.

D.—*Fore-wings brown.*

r. Glossy reddish brown, with a broad silvery stripe divided into three parts of diminishing length.
C, myellus, Hübner.

s. Dark brown with white markings and black spots.
C. Labradoriensis, Christoph.

E.—*Fore-wings brownish lilac.*

t. Brownish lilac (fugacious) with stripe and other markings white.
C. minimellus, Robs.

Note.—*A. nivalis* is taken at Sherbrooke ; *A. auratella* and *C. laqueatellus*, in the Island of Montreal ; *C. Labradoriensis* and *C. minimellus* at Bergerville, *C. myellus* at Levis.

The foregoing information as to the times of appearance, habits, etc., of the different species of the grass eating larvæ will have prepared the way for this declaration :

THE VERY BEST PREVENTIVE TO INJURY FROM THE LEPIDOPTEROUS PESTS OF THE MEADOW AND THE LAWN IS THE USE OF THE IRON ROLLER.

The best form of roller for field use is the toothed roller formed in sections. This should be passed over the meadows in spring when the grass begins to shoot, and, if possible, at night, for then both the hibernated and the newly-hatched larvæ will have left their retreats and be at work.

Again the roller should be used after the hay-crop has been taken from the fields, for it will then kill such larvæ and pupæ as have been shaken into the under-growth.

Of course in the use of the roller as in other things, judgment needs to be exercised. *It would not do to pass it over heavy clay-lands in wet weather.*

When an assault of the Army-worm upon standing crops is anticipated, a deep furrow should be run around the meadow. This would disconcert and entrap the foe ; and a suitable log attached by a chain to a whiffle-tree should be in readiness, to draw along the trench, as often as may be necessary, for the purpose of crushing the assailants.

The use of Paris green about the meadows and pasture lands cannot—under ordinary circumstances—be recommended. It is far too dangerous.

RARE CAPTURES DURING THE SEASON OF 1896.

BY ARTHUR GIBSON, TORONTO.

It is my intention here to give the benefit, if any, of a few notes I made, and to briefly describe some of the rarer captures and observations in Lepidoptera, which have personally come under my notice during the collecting season just closed.

The present year has been a most remarkable one for the appearance and capture of interesting and rare specimens of Lepidoptera, in and about the neighborhood of Toronto. Butterflies which have never been recorded as having been taken in this part of Ontario, previous to this year, have been collected in considerable numbers during the past summer, while others which were seldom seen on the wing here have been observed and taken again and again. It is something very unusual for this locality to see so many strangers in the butterfly line, as have paid a visit to Toronto throughout last summer. Whether we shall see the same insects here again next year remains to be seen.

The very first specimen which I met with this last season proved to be a good one, and one which I was exceedingly pleased to get. While out on Saturday afternoon, the 11th April, getting some larvæ of *Arzama obliquata*, I took my first specimen of *Brephos infans*. This beautiful moth I found lying in a small pool of water, where the ice had

melted, close to the bank leading down to the marsh. It was a perfect specimen and I presume had probably just emerged from the pupa, and fallen into the water, where it had ended its short existence.

Argynnis Atlantis,—This butterfly was very common at the Forks of the Credit, on the 1st July, especially on the milk weed, where it could have been taken in any numbers.

Argynnis Bellona.—Appeared to be fairly common at Lorne Park. Took two specimens on the 11th July. Saw several more.

Argynnis Myrina.—To me this insect was very rare this last summer. Only saw one specimen during the whole season, and that I took in the early part of the summer.

Libythea Bachmani.—This very pretty butterfly, Fig. 90, so easily recognized by its long palpi and angled forewings is seldom met with in Canada. I had the pleasure of taking a perfect specimen at Caesarea, Lake Scugog, on the 12th August last. The only previous Canadian captures of this insect, which have been recorded up to August, of this year, have been made at Toronto, Port Stanley, London and Hamilton.

FIG. 90.

Chrysophanus Thoe.—(Fig. 91 the male; Fig. 92 the female.) Although this insect has often been met with in Toronto, I have never taken it here. While away on my holidays, I took my first specimen at Caesarea, on the 12th August. Only saw the one specimen.

FIG. 91.

FIG. 92.

Pieris Napi—Summer form *Oleracea-æstiva.*—This butterfly was very common at the Forks of the Credit, on the 1st July. I could have taken any number of specimens but confined myself to about 30. I also took this insect at Caesarea, Ont., on the 12th August, where it also appeared to be fairly common. I might add that I took one specimen at Lorne Park, on the 11th July.

Meganostoma Caesonia.—(Fig 93) As has been previously mentioned this insect made its first appearance in this neighborhood during the past season, and was fairly common. The first time I noticed it was on the 13th June, when I took three specimens, and also observed it several times later in the same month, and on the first of July at the Forks of the Credit.

FIG. 93.

Papilio Ajax.—While strolling through High Park, on the afternoon of the 14th June, I observed, to me, the first living representative of this Papilio flying very slowly over some small bushes. On June 20th I succeeded in taking a worn specimen and on the 23rd of the same month saw another specimen which looked to be perfect, but as I did not have any appliances handy, did not take it. I also observed this butterfly on the 1st and 11th July.

Papilio Philenor.—(Fig. 94.) I should not like to say for sure, but I am pretty well satisfied that I saw a specimen of this butterfly in High Park, on the 20th June. Gave chase to it but to no effect. I do not know whether this Papilio has ever been taken in Toronto or not.

Fig. 94.

Catocala cerogama.—This was one of our commonest Catocalas here this year. One night alone over twenty specimens were taken. It is usually a rather uncommon moth, and of late years has not been met with very often.

Catocala ilia—This beautiful moth was quite plentiful at "sugar" during the past season. I took my first specimen on the 20th July and also secured it several times later.

Catocala neogama.—I took one specimen of this insect on the 3rd August. This is considered to be a rather rare Catocala in this locality.

Catocala retecta.—The black underwings are always eagerly sought after. Several *retectas* were taken here this year. I took my first one on the 24th August.

Catocalas were unusually early this year, most of them being taken in July and August, while in other years I have always taken them towards the end of August and beginning of September.

THE BUTTERFLIES OF THE EASTERN PROVINCES OF CANADA.

By Rev. C. J. S. Bethune, Port Hope, Ont.

In our 25th Annual Report for 1894, pages 29-44, I gave a list of the Butterflies of the Eastern Provinces of Canada, so far as known to me, with localities and other observations. So many interesting records and rare captures have been made since its publication, in addition to those given in the preceding paper by Mr. Arthur Gibson, that it seems desirable to publish them here. For convenience of reference, I prefix to the name of the species the number given in the 1894 list.

1. Danais Archippus, *Fabr.*—Halifax, N. S., rare: Mr. Harry Piers (Proc. Nova Scotia Institute of Natural Science, vol. ix., part I., page xix.)

2. Euptoieta Claudia, *Cram.*—This rare butterfly (Fig. 95) was taken in High Park, Toronto, by Mr. Arthur Gibson, in July, 1893.

Fig. 95.

3. Argynnis Cybele, *Fabr.*—Taken at Sudbury (J. D. Evans); Orillia, common June 16 to August 31 (C. E. Grant). Miss Eaton mentions its capture at Truro, N. S., but Mr. Piers considers that there is some doubt about its identification. (Proc. N. S. Institute—*loc cit*).

4. Argynnis Aphrodite, *Fabr.*—Orillia, June 23 to August (C. E. Grant); Halifax, N. S., abundant (H. Piers)

5. Argynnis Atlantis, *Edw.*—This northern species has greatly extended its range and is now recorded from Orillia, common June 4 to August (C. E. Grant); Toronto and Port Credit, June, July, and August, 1896 (C. T. Hills); London, Sarnia, and Windsor, June and July, 1895 (J. A. Moffat); Truro, N. S., very common (Miss Eaton).

8. Argynnis Myrina, *Cram.*—Orillia, common, two broods, June and August, C. E. Grant); Truro, N. S., (Miss Eaton); Halifax (H. Piers).

9. Argynnis Chariclea, *Ochs.*—"Ranges from Labrador, Hudson Bay and Gulf of St. Lawrence on the east to probably about lat. 51′ 25′ on the Pacific Coast, nowhere extending into the United States." (F. M. Webster, Can. Ent. xxvi. 119.)

10. Argynnis Freija, *Thunb.*—"Alaska to Labrador and westward to the Rocky Mountains, which range it follows southward to Colorado, about lat. 39°." (F. N. Webster); Calgary (Wolley Dod).

118. Argynnis Idalia, *Drury.*—This lovely addition to the list of Canadian Butterflies was taken at Windsor, Ontario, last year, by Mr. W. S. Cody, who kindly presented a specimen to the Society's cabinet. St. John, N. B. (H. E. Goold).

13. Melitæa Phaeton *Drury*—Very rare at Truro, N. S. (Miss Eaton); Halifax, (H. Piers).

15. Phyciodes Nycteis, *Doubl-Hew.*—Orillia, fairly common in June (C. E. Grant); Port Hope, second week in June, 1896. Fig. 96.

17. Phyciodes Batesii, *Reak.*—Mr. C. E. Grant has taken one specimen of this rare butterfly in July, at Orillia, Ont.

Fig. 96.

18. Phyciodes Tharos, *Drury.*—Orillia, common May 24th to July, (C. E. Grant); Truro, N. S. Miss Eaton); Halifax; "very common throughout the Eastern Provinces" (H. Piers).

19. Grapta Interrogationis, *Fabr.*—Has usually been considered a rare butterfly in the Province of Quebec, but this year it has been found in great abundance, the larvæ feeding on elm, in the neighbourhood of Montreal. The form *Umbrosa* was abundant at Port Hope in May and June, and *Fabricii* was taken July 29, and as late as November 16, 1896.

20. Grapta Comma, *Harr.*—Sudbury (J. D. Evans); both forms fairly common at Orillia, (C. E. Grant).

22. Grapta Faunus, *Edw.*—Sudbury (J. D. Evans); Orillia, rare (C. E. Grant); Truro, N. S. (Miss Eaton).

23. Grapta Progne, *Cram.*—Orillia (C. E. Grant); Truro, N. S., not common (Miss Eaton).

24. Grapta Gracilis, *Grote and Rob.*—Orillia, two specimens in July (C. E. Grant.

25. GRAPTA J. ALBUM, *Boisd.-Lec.*—Sudbury (J. D. Evans); Orillia, common in September (C. E. Grant); Truro, N. S., very rare Miss Eaton).

26. VANESSA ANTIOPA, *Linn.*—Truro, N. S. (Miss Eaton).

27. VANESSA MILBERTI, *Godt.*—Sudbury and Orillia, Ont.; Truro, N. S.

28. PYRAMEIS ATALANTA, *Linn.*—Sudbury and Orillia, Ont.; Halifax, common (H. Piers).

30. PYRAMEIS HUNTERA, *Fabr.*—Orillia (C. E. Grant); Halifax, occasionally abundant (H. Piers).

31. JUNONIA CÆNIA, *Hubn*—Don River Valley Toronto, May 23, 1896 (C. T. Hills); two specimens at Toronto in 1895 (C. H. Tyris).

32. LIMENITIS ARTHEMIS, *Drury.*—Sudbury and Orillia, Ont.; Truro, N. S.

34. LIMENITIS URSULA, *Fabr.*—Fig. 97.—Taken at Niagara Falls, Ont., June 25, 1895, and at Port Credit by Mr. C. T. Hills.

35. LIMENITIS DISIPPUS, *Godt.*—Orillia, second brood in July and August in low lands (C. E. Grant); Truro N. S. (Miss Eaton).

36 DEBIS PORTLANDIA, *Fabr.*—Sudbury (J. D. Evans); two specimens were taken at Matchedash Bay, near Coldwater, County of Simcoe, Ont., August, 1883 (C. E. Grant). Fig. 98.

FIG. 97.

FIG. 98.

37. NEONYMPHA CANTHUS, *Boisd.-Lec.*—Sudbury; Orillia, common in low meadows in July (C. E. Grant); Truro, N. S.; and Lower Stewiacke, N. S. (H. Piers).

38. NEONYMPHA EURYTRIS, *Fabr.*—Orillia, common in open woods in June (C. E. Grant).

42. SATYRUS ALOPE, *Fabr.*—Niagara Falls, Ont., July 14, 1896 (A. Gibson); Truro, N. S., rare (Miss Eaton).

45 LIBYTHEA BACHMANI, *Kirtl.*—Taken in Toronto in 1895, and June 7, 1896, by Mr. McDonagh. Fig. 90.

46 THECLA ACADICA, *Edw.*—Orillia, usually rare, but very abundant in July, 1896, when forty specimens were taken by Mr. Grant; Toronto, June and July (C. T. Hills).

48. THECLA EDWARDSII, *Saund.*—Toronto, June and July (C. T. Hills).

49. THECLA CALANUS, *Hubn.*—Sudbury (J. D. Evans); Orillia, rare, taken in July (C. E. Grant

50. THECLA ONTARIO, *Edw.*—A specimen of this extremely rare butterfly was taken near Grimbsy on the 24th of June, 1894, by Mr. Wm. Metcalfe of Port Hope. The only specimen previously known was taken twenty-six years before at Port Stanley by Mr. E. Baynes Reed.

51. THECLA STRIGOSA, *Harr.*—This rare butterfly, Fig. 99, was taken at Orillia in July by Mr. Grant, and at Toronto in June and July by Mr. C. T. Hills.

FIG. 99.

119. THECLA HUMULI, *Harr.*—This is another addition to the list of Canadian butterflies; it was taken at Sudbury by Mr. Evans.

58. FENISECA TARQUINIUS, *Fabr.*—Orillia, moderately common in one locality (C. E. Grant).

63. CHRYSOPHANUS HYPOPHLÆAS, *Boisd.*—Orillia (Grant); Truro, N. S., very common (Miss Eaton).

67. LYCÆNA PSEUDARGIOLUS, *Boisd.-Lec.*—Orillia; the form *Lucia* is very common in April and May; *Neglecta* is not so abundant in July and August (C. E. Grant); Truro, N. S., rare (Miss Eaton); Halifax, "abundant in the spring and familiar to trout fishermen under the common name of 'Jenny Lind'" (H. Piers).

68. LYCÆNA COMYNTAS, *Godt.*—Toronto in June (C. T. Hills).

69. PIERIS PROTODICE, *Boisd.-Lec.*—Orillia, formerly common; one male was taken in August, 1895 (C. E. Grant

70. PIERIS NAPI, *Esper.*—Orillia, the spring and summer forms are common; *Virginiensis* has also been taken (C. E. Grant); Truro. N. S., not very common (Miss Eaton).

71. COLIAS CAESONIA, *Stoll.*—Fig. 93.—The sudden appearance of this butterfly in considerable numbers in several localities in Ontario during the summer of 1896, is very remarkable. It was taken at Orillia by Mr. James Walker on July 13, and by Mr. Grant from June 6 to July 13; at Toronto by Messrs. C. T. Hills, C. H. Tyris and A. Gibson from June 11 to the end of the month; Little York, near Toronto, June 14. It was also taken at Cartwright, Manitoba. on June 19 by Mr. E Firmstone Heath.

72. COLIAS EURYTHEME, *Boisd.*—Sudbury (J. D. Evans); Orillia, common in 1872, not seen since (C. E. Grant).

78. TERIAS MEXICANA, *Boisd.*—No further record, but a cut is given, Fig. 100, to aid in its identification should it again make its appearance in south-western Ontario.

FIG. 100.

79. PAPILIO AJAX, *Linn.*—Port Hope at the end of May and on June 18, 1896; Toronto, four specimens during June (C. T. Hills), in addition to those observed by Mr. Gibson.

81. PAPILIO CRESPHONTES, *Cram.*—Taken at Orillia by Mr. Grant. In 1894 we gave a figure of this splendid butterfly and are now able to present pictures of the caterpillar, Fig. 101, and the chrysalis, Fig. 102.

85 PAPILIO PHILENOR, *Linn.*—A specimen was taken at Port Hope, on the 5th of August, 1896; this is the first time it has been observed east of Toronto in this Province. Fig. 94.

87. ANCYLOXYPHA NUMITOR, *Fabr.*—Humber River, near Toronto, and at Port Credit, in June, July and August (C. T. Hills).

89. PAMPHILA ZABULON, *Boisd.-Lec.*—The form *Hobomok* was abundant in sunny places in the woods near Port Hope during the first and second weeks in June, 1896; both forms common at Orillia in May and June (C. E. Grant).

94. PAMPHILA MYSTIC, *Scud.*—Orillia, common in June and August, two broods (C. E. Grant); Truro, N. S. (Miss Eaton).

95. Pamphila Cernes, *Boisd.-Lec.*—Sudbury (Evans); Orillia (Grant); Truro, N. S. (Miss Eaton).

97. Pamphila Metacomet, *Harris.*—Toronto in July (C. T. Hills); Orillia, scarce, in July (C. E. Grant).

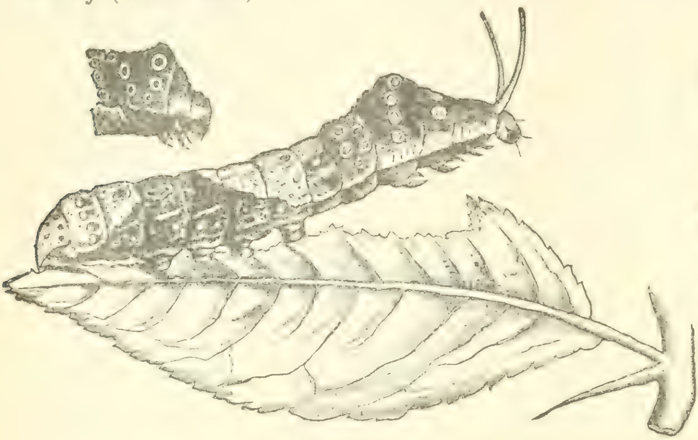


Fig. 101.

Fig. 102.

104. Pyrgus Tessellata, *Scud.*—This rare butterfly, Fig. 103, which has only been recorded in Canada as having been taken in Essex County, Ontario, many years ago, was taken in the early part of October, 1895, by Mr. Anderson, at London, Ont.

Fig. 103.

106.—Nisoniades Brizo, *Boisd.-Lec.*—Orillia, scarce (C. E. Grant).

107. Nisoniades Icelus, *Lint.*—Orillia, not uncommon in May, June and July (C. E. Grant).

108. Nisoniades Lucilius, *Lint.*—Orillia, scarce (C. E. Grant).

109. Nisoniades Juvenalis, *Fabr.*—Sudbury (J. D. Evans); Orillia, not uncommon in May and June (C. E. Grant).

112. Pholisora Catullus, *Fabr.*—Orillia, rare, June (C. E. Grant).

114. Eudamus Pylades, *Scud.*—Port Hope, abundant in sunny places in the woods during the first two weeks of June, 1896; Orillia, abundant at the end of May and in June (C. E. Grant).

OBITUARY.

John M. Denton.

It is with profound regret that we record the death of our old friend and highly esteemed colleague Mr. John M. Denton, of London, Ontario, who was one of the early members of the Entomological Society and always took a very lively interest in its welfare. For some months he had been in poor health owing to an affection of the liver, but was able to attend his place of business from time to time and to take part in the proceedings of our annual meeting in November 1895, when many of us saw him for the last time. In January, his illness assumed a more acute form and confined him to the house. On Tuesday, March 24th, he was seized with paralysis and before midnight passed peacefully away.

Mr. Denton was born in Northampton, England, on the 19th of September, 1829. His father was a farmer by occupation, and he was consequently brought up in the country amidst rural scenes and learnt there to love and observe the beauties of nature. At the age of fourteen he was apprenticed to a woollen draper and tailor, and spent seven years in thoroughly learning the trade and becoming proficient in all its details. For a few years he was engaged in business on his own account, and in 1855 married Miss Ann Walker, of Somersetshire, England, who survives him. He then emigrated to Canada and settled in London and at once resumed his occupation as a tailor, having but little to begin upon, except a hopeful heart and a thoroughly practical English training. By patient industry, unfailing courtesy and unswerving integrity, he built up by degrees a most successful business as a merchant tailor, and won the respect and esteem of the whole community.

Living on a farm in his boyhood and apprenticed at so early an age, he had but little opportunity of acquiring a literary education, but by constant application and careful reading he overcame these disadvantages, and attained a more than ordinary knowledge of the subjects that interested him. Foremost among these was Entomology, which he studied especially in its economic aspects as affecting live stock, fruit trees, garden and field crops. He became an authority on these topics and was frequently called upon to address meetings of farmers and fruit growers and give them the benefit of his knowledge and experience. His love of the farm continued throughout his life and he devoted much of the time that he could spare from business to the cultivation of a fruit farm a few miles from London. He was no mean authority upon horses and cattle and had a considerable knowledge of their diseases and most satisfactory treatment. He was also an adept with the microscope and took great delight in searching into the hidden beauties of nature.

When the London branch of the Entomological Society was formed in July, 1864, he was one of the original members, and took a most active interest in it and the parent Society to the close of his life. He was elected Vice-President of the London branch in 1872, and President in 1878 and several years following. In 1871, he became a member of the Council of the parent Society and continued to hold office for five and twenty years; in 1892 he was elected Vice-President, but he would never allow himself to be nominated for the Presidency, though urged to do so more than once. He was also an active member of the Ontario Fruit Growers' Association and gave much assistance to its work.

He was a man of deep religious feelings and of earnest but unobtrusive piety. Though a leader of the Plymouth Brethren, he never obtruded his views upon those who differed from him The writer knew him well for a great number of years, and during his visits to London often enjoyed his hospitality, but never did he hear a word fall from his lips that could wound in the slightest degree the susceptibilities of those who did not accept the theological opinions that were so dear to him. He was a good, honest, sterling man, whom all respected and whom his friends loved; kind, charitable and generous; courteous in manner, most hospitable in his home, above reproach in business; a man who is a distinct loss to the city in which he lived, and whose death creates a blank in the hearts of his friends which can never in this life be filled. To his childless, sorrowing widow we tender our deepest, sincerest sympathy.

C. J. S. B.

Captain J. Gamble Geddes.

It is our painful duty to record the loss of another active member of the Entomological Society of Ontario. At 2 o'clock on Good Friday morning, April the 3rd, Captain J. Gamble Geddes died after a few days' illness brought on by a severe cold. He was born in Montreal in 1850 and educated there. When a young man he entered the service of the Molsons Bank and was for some time attached to the office in London. He at once joined the Society and became an enthusiastic member. In 1874 he was elected Secretary-Treasurer of the London Branch; in 1875 Vice-President; and in 1876 Presi-

dent. He left London on his appointment as Manager of the agency of Molsons Bank at Millbrook. Here living in the country he devoted most of his leisure time to the collection and study of insects, applying himself especially to the Lepidoptera. In 1880 he left the bank and was appointed aide-de camp and private secretary to the Hon. John Beverley Robinson during his term of office as Lieutenant-Governor of Ontario. Being fond of society, of handsome presence and devoted to music, he became a great favourite among the social circles of Toronto, among whom much of his time was accordingly spent. He did not, however, abandon the pursuit of Entomology, but succeeded by correspondence and exchange, in addition to the captures of his own net, in forming a large and valuable collection of butterflies from all parts of the world. This he subsequently sold to the Dominion Government and it now forms the nucleus of the collection in the Geological Museum at Ottawa. He made expeditions in 1883 and 1884 to Manitoba and the Northwest Territories as far as the Rocky Mountains in quest of butterflies and added much to the knowledge of their geographical distribution and habits. On several occasions he visited England, and spent some time in Germany, and also in Bermuda. Wherever he went he made the acquaintance of the leading Entomologists and added to his stock of knowledge.

His first contribution to the *Canadian Entomologist* was in 1874, when he wrote No. 14 of a series of articles on "Some Common Insects"—"The Common Cockchafer," C. E. vol. vi. p. 67. His subsequent papers were the following: "List of Diurnal Lepidoptera collected in the Northwest Territories and the Rocky Mountains in 1883," C. E. xv., 221; xvi., 56, 224; xvii, 120; one hundred and twenty-six species were enumerated.

"Euptoieta Claudia," C. E. xvii., 60 (1885).

"Notes on three small collections of Diurnal Lepidoptera made in 1886." (These were made in Newfoundland, the Kamanistiquia River, Lake Superior, and Hudson Straits.) C. E. xviii., 204.

"Some notes on the genera Colias and Argynnis whilst alive in the imago state," C. E. xix., 166 and 230 (1887).

"Notes for collectors visiting the Prairies and Rocky Mountains," C. E. xxi., 57 (1889).

"Colias Chione," C. E. xxi, 59.

He also contributed the following articles to the Annual Reports of the Society:—

"Some remarkable captures in Ontario," 18th Report, 1877, p. 21.

"On some of the collections in England and the German Empire," 22nd Report, 1891, p. 31.

"Insects collected in Bermuda during the winter of 1894," 25th Report, 1894, p. 25.

In addition to his love for Entomology, he took a great interest in philatelics, and formed a large and valuable colleotion of postage stamps. He was an accomplished musician and usually sang in the choir of the church that he attended; he was also a member of the Philharmonic Society of Toronto. He belonged to the Masonic Order, in politics was a strong Conservative, and in religion a member of the Church of England. His wife, who was a daughter of the late Edward C. Jones, of Toronto, died a little more than a year ago. The untimely death of Captain Geddes was no doubt hastened by her loss. They have left two little orphan girls, aged three and five years respectively.

The writer, who knew him intimately from his boyhood, deeply deplores his loss, and his grief is shared in by a very large circle of relatives and friends.

C. J. S. B.

Miss G. E. Ormerod.

It is with deep regret that we record the death of Miss Georgiana Elizabeth Ormerod, of Torrington House, St. Alban's England, the elder sister of Miss Eleanor A. Ormerod, whose name as a distinguished Entomologist is known throughout the scientific world. After several months' of patiently borne illness, she passed away on the 19th of August

last, full of piety and good works, and justly esteemed and loved by all who knew her. She and her sister were each other's constant companions and fellow workers, and each sought the other's counsel and aid in carrying out any plan of work in which she was engaged. Miss G. E. Ormerod's special studies were botany and conchology, and in the latter department she formed a large and valuable collection of shells which she presented a few years ago, to the Natural History Museum at Huddersfield. She was highly gifted as a linguist, and acquired an excellent knowledge of French, Italian, Spanish and German, and was thus enabled to be of the greatest assistance to her sister in correspondence and the translation of foreign works of science. She is most widely known, however, by her remarkable talents as an artist, which were employed in the illustration of her sister's works, and in the production of a splendid series of diagrams in which are depicted a large number of the most important injurious insects in all their life-stages.

In addition to her scientific and artistic work she devoted much of her time and means to benevolent objects, and carried out for many years at her own expense a system of distributing books of an entertaining and instructive character amongst the working classes.

Women of such a type are rare, and we cannot but deeply deplore the loss of this eminent Christian lady, who died at an advanced age, full of good works, performed in a most unobtrusive manner; richly endowed with intellectual and artistic talents which she largely used for the benefit of others; always happy and cheerful in her daily domestic life; kind, hospitable and sympathetic: ready to help all who deserved her aid, and to give wise counsels to those who sought them from her.

To her sister—her life-long colleague—the loss is beyond what words can express. We can only venture to offer to her our heart-felt sympathy and our earnest wish that she may have grace and strength to endure so heavy a blow.

C. J. S. B.

ENTOMOLOGICAL LITERATURE.

THE GYPSY MOTH.—A report of the work of destroying the insect in the Commonwealth of Massachusetts, together with an account of its history and habits both in Massachusetts and Europe. By E. H. Forbush and C. H. Fernald.

This report, a handsome volume of nearly 600 pages, well printed and most copiously illustrated with chromolithographs, photogravures and wood cuts, gives a full account of the introduction of the now notorious "Gypsy Moth" into America by Leopold Trouvelot in 1868 or 1869, traces its history, and records the efforts which have been made to exterminate it by the State of Massachusetts up to the end of 1895. The spread of this insect for the first ten years was remarkably slow in the light of what we now know of its capabilities for harm. During that period it was not noticed by anyone but the introducer. The first extensive outbreak was in 1889, but for ten years before that it had given great annoyance to the people living in the part of the town of Medford, where it was first introduced. It had also spread and had gained a foothold in thirty townships without attracting public attention. Since that time its history is well known. In 1890 the first Gypsy Moth Commission was appointed and the work of fighting the pest was inaugurated. In February of the next year this commission was removed and another one substituted. On 12th of March Mr. E. H. Forbush, the present very efficient "Director of field work," was appointed, and on 18th June Prof. C. H. Fernald began his labors as entomological adviser. Since that time the work has been pushed on with great energy and the present valuable report is an outcome of the combined efforts of a practical, energetic manager and a careful, scientific entomologist. The two parts of this report prepared by the above named officers are quite distinct and form together a very complete treatise, not only upon the Gypsy moth, but upon the general principles which it is necessary to study when combatting any injurious insect. This carefully prepared report, therefore, cannot but be for a long time an indispensable book of reference for economic entomologists.

There are in this volume many things which will attract the attention of entomologists. Indeed, it is so full and there are so many different subjects treated of, that even to give the titles would take more space than is at my disposal. The first thing which will be noticed is the adoption of the generic name *Porthetria*. Articles of particular note deal with the studies made as to the methods of distribution of the Gypsy moth and the measures practised for the destruction of the insect in its different stages; spraying apparatus, and particularly the care of spraying machinery; methods of pruning, and some charming observations upon insect-eating birds.

The scientific work contained in Professor Fernald's report is of great value and contains a record of most painstaking and patient work. Probably one of the most interesting sections is that which deals with Natural Enemies, in which most excellent work has been done. Prof. Fernald has been aided in this work by efficient assistants, and the whole information so gained has been pieced together by a master hand.

With regard to spraying, some surprising results have been obtained. In the first place the caterpillar of the Gypsy moth seems to be little affected by applications of Paris green when applied of the strength ordinarily used for other mandibulate insects. Mr. Forbush says: "It became evident before the end of the season of 1891 that spraying, while reducing the numbers of the moth, could not be relied upon as a means of extermination, for many caterpillars survived its effects."

The following conclusion on page 139 will show entomologists that the matter of controlling mandibulate insects, by means of active poisons, is still a fertile field for careful work, in which useful and laurel-bearing results are still to be reaped:

"Every effort was made during the spraying season to determine why the results of spraying were not uniform and satisfactory. The feeding caterpillars were watched day and night by many observers. The spraying was most carefully superintended and the conclusion finally arrived at was that, under ordinary conditions, spraying with Paris green for the Gypsy moth was ineffective and unsatisfactory."

Paris green was on the whole the most fatal insecticide, and when used in the proportion of one pound to 150 gals. of water did not burn foliage, but with larger proportions did considerable harm. The injury developed so rapidly that within a short time the leaves were all killed and the surviving larvæ had to go elsewhere to feed. "Therefore, a strong Paris green mixture had little better effect than a weak one. Lime was then used with the Paris green with a view of neutralizing the burning, but considerable injury to the foliage still continued."

Probably one of the most remarkable facts discovered by the entomologists is related by Professor Fernald on page 476, where he says: "One interesting result obtained from the analysis of the different stages of the Gypsy moth, made in 1893 and 1894, is that pupæ and imagoes from caterpillars which have been reared on leaves sprayed with Paris green or arsenate of lead, may contain arsenic in recognizable quantities. Several pupæ and a few female imagoes obtained under these conditions, when subjected to chemical analysis gave ample evidence of the presence of arsenic in their bodies. This shows that the presence of arsenic in the pupa may not materially interfere with the processes involved in the development of the imago. Since, as has been repeatedly demonstrated, moths reared from poisoned larvæ are capable of reproduction, it is also evident that the arsenic contained in their bodies does not injure the reproductive function."

With reference to the amount of arsenic which could be consumed by some of these caterpillars, and yet leave them "normally active and healthy," it was found that some of them had in their bodies in proportion to their weight, an amount equivalent to 12½ times the fatal dose for an adult human being, in proportion to the weight of the latter.

The work of the Gypsy Moth Committee has been criticized, examined and studied by practical men who were entomolgists and others who were not. As far as I can learn, the general verdict is that excellent work, and, under the circumstances, remarkably so, has been done. The insect is not exterminated, it is true; but there seems every reason to hope, judging from what has been done and the behaviour of the species in other countries

where it was once alarmingly abundant, that this is possible, if money is supplied and if it is given at the time when it can be made use of to the best advantage. On pages 38 to 93 of the report will be found an instructive account of the constant efforts of the Committee to get funds to carry on the work properly, and year after year it was the same story of reduced, and what was almost worse, delayed appropriations, resulting in the necessity of modifying the whole plan of work arranged for the year, so that instead of making vigorous efforts for the extermination of the insect, and fighting it at the time this could be most effectively done—early in the season, when the caterpillars were small—all that could be done was to try and prevent the further spread of the enemy from the localities known to be infested. The appropriations which have been made for this work are considerable, about $525,000 up to the present time, and this amount would certainly have produced far better results, could the Committee have obtained the grants at the time they required them, so that they could have begun the work early in the season and continued employing, from year to year, those assistants who had been taught, at an expense of much time and trouble, what was required of them. J. F.

Report of Observations of Injurious Insects and Common Farm Pests During the Year 1895, with Methods of Prevention and Remedy. Nineteenth Report, by Eleanor A. Ormerod, F. R. Met. Soc., etc.

This splendid report fully sustains the high standard of excellence which has characterized Miss Ormerod's previous publications. The preface shows that the unusual and prolonged low temperature of the winter of 1894-95 had apparently but little affected the insects which it might be supposed to destroy.

The following pests are treated of in separate chapters: Apple, *Smerinthus ocellatus*; bean, *Bruchus rufimanus* and *B. fabæ*; cabbage, *Ceutorhynchus sulcicollis*; corn and grass, *Charæas graminis*, *Cetonia aurata*, *Phylloperitha horticola*, *Melolontha vulgaris*, *Rhizotrogus solstitialis*, *Tipula maculosa* and *Oscinis frit*; gooseberry, *Bryobia pretiosa*, *B. ribis* and *Nematus ribesii*; mangolds, *Aphis rumicis*, *Silpha opaca* and *Atomaria linearis*; orchard caterpillars, *Cheimatobia brumata*; pine, *Astynomus ædilis* and *Retinia buoliana*; plum, *Scolytus rugulosus*; strawberry, *Harpalus ruficornis*, *Pterostichus madidus* and *P. vulgaris*; turnip, *Helophorus rugosus*.

The ravages of the bean weevil appear to have been serious, and those of the ground beetles, upon the strawberry, have been more extensive than in previous years. Ninety-three pages are occupied with the discussion of the above mentioned insects, while fifty are allotted to "Flies injurious to horses, cattle," etc. These chapters are exceedingly interesting, and several species of Hippoboscidæ, Tabanidæ, and Œstridæ, which are very annoying and injurious to domestic animals, are fully and clearly discussed. In connection with the account of the attacks of the Forest Fly, *Hippobosca equina*, are given two magnificent plates showing upper and side views of the foot of this fly, the tarsi of which are so modified as to enable it to secure a most firm grip on the hairs of the animal upon which it alights. The report concludes with a chapter on Deer and Dog Ticks, very troublesome mites belonging to the Ixodidæ. W. H. H.

British Butterflies, by J. W. Tutt, F.E.S., London: George Gill & Sons, 1896. Pp. 469. (Price 5s.)

It is only a few months since we spoke in terms of commendation of Mr. Tutt's Manual of the British Moths, and now we have before us an even better work on the butterflies by the same industrious author. About one-fourth of the book is taken up with the general subject, presenting a series of chapters on the four life stages of butterflies, their variation and its causes, hibernation and æstivation, classification, collecting, arranging and preserving specimens, and the inflation of larvæ. These are written in the author's pleasant, easy style, with which his previous works have made us familiar, and convey much information of interest to butterfly-hunters everywhere. We are glad to observe that he insists very strongly upon the importance of labelling specimens with the place and date of capture, though the English mode of using short pins and setting the specimens low down makes this a matter of difficulty.

The descriptive portion of the work is excellent and much more complete than that of any manual of British butterflies that we have met with. In the case of each species there are given the English and scientific names, reference to the plate where it is figured, synonymy and bibliography, a concise description of the imago, a paragraph on "variation" in which are mentioned any known aberrations, forms of varieties, as well as sexual distinctions, descriptions of the egg, larva, pupa, notes on the time of appearance, habitat and geographical distribution. Thus it will be seen that proper regard is paid to the whole life history of the insect and that the author does not confine his attention to the imago alone. The plates (uncolored) on which each species is depicted are admirable, and should enable any collector to identify his specimens without difficulty; there are also a considerable number of wood cuts throughout the text.

In the arrangement of species the author begins with the "lowest"—the Skippers, Hesperidæ—and proceeds upwards to the Satyridæ, among which he strangely places "the Purple Emperor," *Apatura iris*. His classification, a thorny subject which we do not propose to discuss here, may thus be considered fully "up to date."

To our readers in the British Isles and to those who have collections of British butterflies, we heartily commend this excellent manual. We only hope that it may not be very long before we have some hand book equally good dealing with the butterflies of Canada.—C. J. S. B.

Preliminary Notes on the Orthoptera of Nova Scotia, by Harry Piers. Transactions of the N. S. Institute of Science, vol. ix., 1896.

So little attention is paid to Entomology in the Maritime Provinces that we gladly welcome this contribution to the subject and are much pleased that Mr. Piers intends to devote some years to the study of the order Orthoptera. The paper before us gives some very interesting notes on the habits and range of fourteen common species of cockroaches, crickets and locusts, and describes more at length the ravages committed by *Melanoplus atlanis* on Sable Island, a hundred miles off the coast of Nova Scotia in the Atlantic Ocean.—C. J. S. B.

Insect Life.—A short account of the classification and habits of insects, by F. V. Theobald, M.A., F.E.S.. London: Methuen & Co. Pp. 235. (2s. 6d.)

Under the title of the "University Extension Series" the publishers are issuing a number of books on historical, literary and scientific subjects, which are intended to be both popular and scholarly. We have not seen any of the other works of the series and cannot, therefore, comment upon them, but the book before us seems hardly to come up to the expectations one would naturally form of a manual intended for use in preparation for "University Extension" lectures. The descriptive portion is meagre and will afford a student a very vague idea of the insects belonging to the different orders. It is satisfactory, however, to find in an English publication some attention paid to Economic Entomology and the application of the insecticides, which are in common use here. The book is neatly printed (though we have noticed several misprints in the spelling of names) and is illustrated with over fifty wood cuts.—C. J. S. B.

Critical Review of the Sesiidæ found in America north of Mexico, by William Beutenmüller, pp. 111-148, Bull. Am. Mus. Nat. Hist., VIII., 1896.

The writer of the present brief notice of this excellent paper on the *Sesiidæ* desires to call attention to the very careful work of Beutenmüller on the clear-wings and the necessity for this work which has arisen from the uncritical publications of preceding authors. It appears, for instance, that our *S. lustrans*, a species well distinguished by antennal peculiarities, has been five times the subject of new descriptions by the late Mr. Hy. Edwards, whose species are very properly reduced, as appears from Beutenmüller's studies. The name hitherto used for this species itself must, it seems, give way to *bassiformis*, Walk., described from a type in poor condition. Beutenmuller

is quite correct in calling attention to the particular necessity in this group for good material from which to describe. The want, perhaps, of such material led Mr. Edwards to describe *S. rutilans* six times over. A large number of sexual determinations by Mr. Edwards are corrected by Mr. Beutenmuller, so it seems hardly possible for anyone to have worked with less judgment. The list of the clear-wings in the New York Check List was drawn up, with the rest of the list, by the writer of the present lines, who at the time merely sent the last proof to the late Mr. Hy. Edwards for his revision. Mr. Edwards added, in explanation, the two foot notes on page 12 and signed these, and made one or two changes in his names for genera on page 11. The writer is also responsible for the list of the clear-wings, since he originally wrote the same, and not Mr. Edwards. The explanation is here given, as the list has been erroneously alluded to as the work of Mr. Edwards. In the Philadelphia list the New York list is generally copied, but *lustrans* is wrongly given to Mr. Hy. Edwards, and an implication is conveyed in the preface that Mr. Hy. Edwards was the author of the lists of the clear-wings, which is here corrected. The writer trusts that Mr. Beutennmuller will continue his studies and that lepidopterists generally will help him in every possible manner. It is a matter of great satisfaction that Mr. Beutenmuller's timely work is also of such good quality. The writer would merely reclaim his *Sesia pictipes*, which is also given to Mr. Hy. Edwards, on p. 134, and draw attention to the excellent description of the habits of this species given by the late Dr. Bailey in the pages of the American Entomologist.

A. Radcliffe Grote, A. M.

A List of the Butterflies of Sumatra, with special reference to the species occurring in the north-east of the Island. By L. de Nicéville and Hofrath Dr. L Martin. Calcutta. Reprinted from the Journal of the Asiatic Society of Bengal, 1895.

This list of seven hundred and fifty-six species of butterflies taken in a limited portion only of the great Island of Sumatra, gives one some idea of the wealth of the insect fauna in tropical regions. In a very interesting introduction the authors give a brief description of the Island, which is nearly as large as France and is bisected by the equator, and relate the difficulties that have to be surmounted in the formation of a a collection of its butterflies, which can only be effected by employing natives, who have first to be taught and trained for the purpose. Dr. Martin lived for thirteen years on the Island and has thus been enabled to add very interesting notes on the distribution, scarcity or rarity, habits, season of occurrence, etc., of a large number of species. One may, therefore, open the list anywhere and find not a mere record of names, but highly interesting details regarding the butterflies. As might naturally be expected, the preparatory stages of the majority of the species are as yet unknown.

C. J. S. B.

A List of the Butterflies of Sikhim, by Lionel de Nicéville, F. E. S., etc. Calcutta: from the Gazetteer of Sikhim. Printed at the Bengal Secretariat Press.

Probably no part of the great British Empire of India and its tributary States has been so fully explored by the collectors of butterflies as the country of Sikhim, which includes the famous health resort of Darjeeling, about 7,000 feet above the sea, on the slopes of the Eastern Himalayas. Consequently the author is able to record in this list no less than six hundred and thirty-one species, which he considers a near approach to the maximum number that can be discovered. Certainly it is a goodly number, and one hard to be realized by a dweller in these northern and much less luxuriant regions. And what splendid creatures they are, with their gorgeous colouring and infinite variety of shapes and hues. Nearly fifty species of Papilios alone are recorded, and more than one hundred and fifty Lycænidæ, the greater number of which belong to genera that are entirely unknown to us here.

C. J. S. B.

MONOGRAPH OF THE BOMBYCINE MOTHS OF AMERICA NORTH OF MEXICO, including their transformations and origin of the larval markings and armature. Part I., family 1, Notodontidæ. By ALPHEUS S. PACKARD. National Academy of Sciences, Vol. VII., 1895 (received May 11th, 1896); 292 pages, 49 plates, and 10 maps.

Dr. Packard's long promised monograph has at length appeared. The copious text is divided into ten sections: I., Introduction; II., Hints on the mode of evolution of the bristles, spines, and tubercles of Notodontian and other caterpillars; III., On certain points in the external anatomy of Bombycine larvæ; IV., On the incongruence between the larval and adult characters of Notodontians; V., Inheritance of characters acquired during the lifetime of Lepidopterous larvæ; VI., Geographical distribution of the American Notodontidæ; VII., Phylogeny of the Lepidoptera; VIII., Attempt at a new classification of the Lepidoptera; IX., A rational nomenclature of the veins of the wings of insects, especially of the Lepidoptera; X., Systematic revision of the Notodontidæ, with special reference to their transformations.

Most of these have previously appeared as separate articles, as the reader will recall. The life-histories are given as fully as our present knowledge will allow, much of this knowledge being due to Dr. Packard's own labours. The plates illustrating them are beautifully coloured, the early stages highly magnified. These plates must be seen to be appreciated.

A few remarks in criticism of the memoir will not be understood to imply a lack of appreciation of its many valuable features. In general the synoptic tables of subfamilies, genera, and species are poor and uncritical. They are no improvement over those of the author's monograph of Geometridæ, to which the same criticism applies. In all the figures of larvæ the setæ are imperfectly shown, and their number and position are not to be relied upon. I corrected for Dr. Packard a number of the plates in this respect, but the corrections were necessarily made from memory and on general principles, and there is not a figure which has the authority of a careful copy from nature. Even the special figures in the text are often grossly erroneous; *e. g.*, figure 9, on page 63, where the back and side views of the same larva are shown as different. Dr. Packard also fails generally to describe the arrangement of the setæ in the text.

The classification of the Lepidoptera which is used is original with the author. It has been already presented in the *American Naturalist*, where I have had occasion to notice it. In rejecting the classification of Prof. Comstock, the author argues that the frenulum is of small value in classification, because both frenulum and jugum are present in some Jugatæ, and the frenulum is absent in some Frenatæ. While we may admit this argument for what it is worth, it seems that Dr. Packard entirely misses the great cumulative force of the evidence adduced by Prof. Comstock and others for these suborders. Classifications founded on the venation alone [Hampson], the wing scales [Kellogg], and the antennæ [Bodine] give the same suborders. I have also shown that the larval characters do not support Dr. Packard's view. But Dr. Packard gives no weight to larval characters, in spite of the implication in the title.

HARRISON G. DYAR.

MISSOURI BOTANICAL GARDEN. SEVENTH ANNUAL REPORT, 1896.

Very few reports are more eagerly looked for every year by those who are lucky enough to secure copies than Prof. Trelease's report on the Missouri Botanical Garden and the Henry Shaw School of Botany at St. Louis, Mo. This report contains not only the Director's annual statement on the condition of the Garden and its finances, but also valuable monographs on different genera of plants. In the present volume we find the following: I. *The Juglandaceæ of the United States*, by Prof. Trelease; II. *A Study of the Agaves of the United States*, by A. Isabel Mulford, and III. *The Ligulate Wolffias of the United States*, by C. H. Thompson. A feature of all these annual reports is the magnificent illustrations.

In addition to the above, there is the report of a speech delivered at the sixth annual banquet, by President Henry Wade Rogers, of the North-west University, on The Value

of a Study of Botany, and a catalogue of the "Sturtevant Prelinnean Library" the greater part of which was presented to the Botanical Garden by Dr. E. Lewis Sturtevant in 1892.

One very notable omission from the present volume which we much regret is the printing of the Annual Flower Sermon. Last year it was delivered by the Rt Rev. W. C. Doane, Bishop of Albany.

The first annual event provided for in his will by Henry Shaw, the good man who founded this garden for the enlightenment and happiness of his fellow men, was "The preaching of a sermon on the wisdom and goodness of God, as shown in the growth of flowers, fruits and other productions of the vegetable kingdom.". A lovely poem in prose for the perusal of which by his friends, the writer's copy of the 1893 report is in constant use, is a sermon preached by the Rev. Cameron Mann, from the text "Consider the lilies of the field." This sermon, from a literary standpoint, is charming, and certainly helps to carry out the wise wish of the benevolent founder to inculcate in all a thankful spirit for the many lovely things in the vegetable kingdom which we find strewed with no niggard hand along our walk through life, making our own journey more beautiful and, it is hoped, our friends happier from contact with us.

J. F.

Economic Entomology, for the farmer and fruit grower and for use as a text book in agricultural schools and colleges; by John B. Smith, Sc. D. Philadelphia: J. B. Lippincott Co., 1896. [Price $2.50]

It is rather remarkable, when the self-evident importance of the science of Economic Entomology is considered, that until Prof. Smith issued his excellent manual, which has just appeared under the above title, there was no one American book which a farmer could consult to find the names and proper remedies for the common crop pests which would come regularly before him in a year's working of his land. The author in his long experience first as a member of the staff of the "United States Entomologist at Washington, and subsequently as State Entomologist of New Jersey," has had great opportunities of becoming thoroughly informed on his subject. That he has made the best use of these opportunities, is evidenced by the excellent book which he has now produced. The best way to test anything is to use it. Thus if anyone wishes for information upon anything within the limits of Economic Entomology, the subject of Prof. Smith's book, as, for instance, some one of the regularly occurring insect enemies of crops, *e. g.*, cut-worms, white grubs, canker worms, the Colorado potato beetle, plum curculio or tussock moth, etc., let him turn it up in the index of this work and he will be referred to a clear and concise account of the insect and its habits, together with recommendations as to the best remedies. The identification of the different species is made easy by a profusion of remarkably good illustrations. The whole book, including the index, consists of 481 pages, while the number of illustrations is no less than 483, all of which are unexceptionable if a mental reservation may be allowed as to the three plates of Bumble-bees and Bee flies Nos. 398, 461, and 473, taken evidently from photographs. It seems a pity that these plates should have been included in this work on Economic Entomology. The arrangement of the book, for ease of reference, is well planned and well carried out, the objects the author had in view, as explained in the introduction, being adhered to in a most satisfactory and complete manner. Part I. consists of eight short chapters on the Structure and Classification of insects. Part II. the insect world, which forms the bulk of the book, is a systematic treatment of the various common injurious insects in their natural orders. This portion is particularly well balanced, enough space being devoted to each species treated of to satisfy the inquirer, without, as is sometimes the case, giving undue importance to some at the expense of others. Part III. treats of insecticides, preventive remedies, and machinery. This work cannot fail to prove of great value to the farmer and fruit grower, as well as to the amateur gardener and student of insect life, who will find in it an authoritative book of reference of small size but comprehensive and easy to consult.

J. F.

Household Insects, (U.S. Bulletin No. 4. New Series.)

During the year 1896 several most useful publications were issued from the United States Division of Entomology under the direction of Dr. L. O. Howard. Of particular interest to the general public was Bulletin No. 4, entitled "The Principal Household Insects of the United States." The main part of the volume is prepared by Dr. Howard and his assistant Mr. C. L. Marlatt, and at the end is a chapter by Mr. F. H. Chittenden on "Insects affecting cereals and other dry vegetable foods." To entomologists, who know the literary and scientific work of these gentlemen, it is only necessary to say that this volume is up to, or perhaps even a little above, the usual excellent standard of the papers issued from the U.S. Division of Entomology at Washington. A very few minutes' examination of the different articles in Bulletin 4 will convince anyone of the extreme value of this concise, practical treatise on all the commoner insects which are likely to be found troublesome inside houses. It is almost impossible for one who has made a specialty of entomology to speak in moderate terms of these publications. There is nothing to compare with them published in any other country. When we consider the matter treated of, and the practical way in which it is presented, the manifest care to secure accuracy of statement, the exquisite work of the artist as well as the arrangement and general get-up of the pamphlet, one is tempted to use so many superlatives that any opinion expressed might be thought to be unduly biassed.

A special feature of value in this publication is that it is entirely made up of original American observations, most of them prosecuted in the Division of Entomology, and, as is pointed out by Dr. Howard in the introduction, the very curious but not unexpected condition of affairs was shown in the preparation of this bulletin that of some of our commonest insects the life history is not known with any degree of exactness. The insects treated of are such as are found in houses and which either annoy the occupants by their direct attacks or are injurious to household goods and provisions. These are described in eight separate chapters. J. F.

Miss Ormerod's Twentieth Annual Report, 1896.

One of the pleasantest events of the year for the economic entomologist is the arrival of Miss Ormerod's Annual Report. The liberality with which the distinguished authoress distributes these treasuries to students and public institutions all over the world brings them within the reach of all who may wish to profit by their perusal.*

It is seldom that any series of publications upon a single subject can show year after year such a steadily maintained, and even gradually increased, interest, as has been the case with these reports—new infestations of crops are being constantly investigated, old attacks restudied, and additions made to the previously recorded methods of treatment or prevention. It matters little in what part of the world a student may be located, he will always find something of value which may be profitably applied to his special work in fighting against the crop pests of his own country. The present report is no exception to the general rule. We congratulate our highly esteemed corresponding member on the practical and serviceable manner in which the subjects she treats of are presented to the public. As a writer in the *Queen* newspaper of late date says, "Miss Ormerod's work does not consist in playing with entomology, but is true, valuable, practical, scientific observation, and she enjoys the proud privilege of being regarded as one of the most reliable scientific observers."

On opening the report one is sadly reminded by the frontispiece, an excellent likeness of the late Miss Georgiana E. Ormerod, of the irreparable loss the authoress has suffered in the recent death of her much loved and highly talented sister, who has been her life-long companion and able assistant in the grand work she has done for economic entomology in England. The late Miss Ormerod was a naturalist of no mean

*These reports are also for sale by the publishers, Simpkin, Marshall & Co., London, at the almost nominal price of 1s. 6d.

standing and possessed remarkable talents as an artist. She is well known as the authoress of the magnificent series of thirty colored diagrams of insects injurious to farm crops. These are thirty inches long by twenty wide, and are most suitable for use in a class room or at farmers' institute meetings. In the preface of the report the sad event referred to above is touchingly and fittingly alluded to with a reference to the obituary notice by Dr. Bethune which appeared in the *Canadian Entomologist* for November last.

Among the various short monographs contained in this report of 160 pages many are of interest to Canadian farmers and fruit-growers either from the identical species occurring both in England and Canada, or from a similarity in habits between allied forms in the two countries.

Codling Moth: This is one of the yearly recurring troubles of the fruit grower to which most of the damage to apples may be laid. English experimenters do not even yet seem to have mastered the spraying of apple trees for the prevention of injury by the codling moth. The remedies are given by Miss Ormerod as follows: "Our only really available remedies against this infestation appear to lie 1st in destroying infested apples; 2nd in trapping the caterpillars and destroying their shelters; and 3rd on being well on the alert at the time of the blossoming of the apple, and by careful spraying preventing the very beginning of the attack." In this country the recommendation for the best remedy would be: "Spray with 1 lb. Paris green and 1 lb. lime in 200 gallons of water within a week after all the blossoms have fallen."

Beet Carrion Beetle: We have occasionally in the North-West Territories a rather rare attack upon vegetables such as squashes, spinach, etc., by the larvæ of one of the carrion beetles *Silpha bituberosa.* In England a very similar species has been the cause of serious damage to mangolds, and last season when other food failed attacked potatoes. The carrion beetles feed both on vegetable and decaying animal food. It is suggested by a correspondent to attract the beetles and larvæ from the crop by putting about the infested fields "a few wild pigeons, rooks, hawks or similar *vermin.*" (*Sic.*) The ignorant farmer in England, as well as in other parts of the world, "generally shoots in spring" every hawk he can see. In this country the remedy which would first suggest itself would be dusting the crop with land plaster and Paris green (50 lbs. to 1).

Leather Beetle: An interesting account is given of an attack by *Dermestes vulpinus.* Large numbers of beetles were found in a building where bones had been stored for six or nine months for the manufacture of manure, and not only the bones were honeycombed, but also the posts and floors of the building over them, which were seriously injured by the larvæ, when full-grown, boring into the wood to pupate. Reference is also given to another similar occurrence near Sheerness, in Kent, which was upon even a larger scale than the one treated of by Miss Ormerod. This article is illustrated by excellent figures of the beetle and its various stages, as well as a portion of a perforated bone and a piece of honeycombed wood.

White Cabbage Butterflies: Under the head of cabbage two species of *Pieris* are treated, and powdery dressings are recommended as fresh lime, soot and sulphur. The highly reprehensible practice of using Paris green upon cabbages is referred to, but Miss Ormerod wisely says she could not take on herself the responsibility of advising the treatment, more especially as the feeling against it might probably ruin the sale of the cabbage. There is no doubt of the truth of this last statement. There is never a season passes that instances do not come under the notice of the writer of people expressing fear of buying cabbages lest they may have been poisoned with Paris green. In addition to this the use of such a virulent poison is quite unnecessary. Pyrethrum powder mixed with three or four times its weight of common flour and kept for twenty-four hours in a tightly closed vessel is even more quickly fatal than Paris green, killing every caterpillar the powder falls upon, or upon which the infusion of the powder may run when it has been wetted by dew or rain, and further, this powder is not poisonous to the higher animals.

Croton Bug: An occurrence of this well-known guest at hotels and other large buildings heated with steam, is spoken of. The usual remedies adopted in this country

as powdered borax and the many brands of pyrethrum powder are mentioned, and "stoving" with sulphur is given a prominent place under remedies.

DEER FOREST FLY: For some years Miss Ormerod has made a special study of the *Hippoboscidæ* or Forest flies, and another chapter of her most interesting observations on these little known insects is given in the present report, with excellent figures of the common Forest fly and the Deer Forest fly.

EARWIGS: The injuries of earwigs in hop gardens and to mangolds, swedes and turnips, likewise to apple blossoms, have been serious in 1896. The old method of trapping the insects in inverted flower pots or tin pots containing a wisp of straw has given good results; also beating them at night on to tarred boards.

THE HOUSE FLY (*Musca domestica*, L.): One of the most interesting monographs in this report, at any rate to the general public, is an account of the troubles caused by the common house fly. The life history of the insect is treated of at considerable length with quotations from the several authors who have written on the subject of "flies" and a statement as to the serious annoyance by house flies in India upon horses. Dr. Spooner Hart, V.S., of Calcutta, sent numerous specimens of a fly which was examined carefully by specialists and found to be true *Musca domestica*. He says: "March 24th. It is the worst pest the horse has here, and at this time of the year it exists in thousands especially in the suburbs. It attacks in great numbers the eyes principally, and is constantly flying off and coming back all day long to the same site. This causes great irritation and inflammation, which, being continued day after day and neglected, will lead to blindness, disfiguration of the eyes and ulceration of the face.

"Our hackney carriages (cabs) here are drawn by wretched half starved ponies fed principally on grass, out all day exposed to the sun, stabled in filthy holes and are most disgracefully treated and neglected. Dozens of these unfortunate creatures are blind from irritation set up by these flies, and present huge ulcers on either side of the face just below the eyes, the result of constant lachrymation and irritation of the flies. The eyelids are thickened and averted and the appearance is awful. The flies are dreadfully persistent, and will not be shaken off." Under the head of Prevention and Remedies it is pointed out that as house flies as far as is actually known for certain, breed wholly in horse manure, much may be done to lessen the numbers by keeping stables clean and removing as quickly as possible all horse droppings and getting them into the land as soon as convenient. Further, as many observers believe that house flies breed also in other decaying matters it is advised to pay special attention to garbage thrown into ash pits.

With regard to the attacks of flies to horses' ears, eyes, etc., Dr. Hart writes that a carbolic wash when freshly applied will keep the flies away. Horses in India are also protected by eye fringes, made of hanging white cords which cover the eyes and prevent the flies from settling. The irritation to horses described above reminds us of the distressing accounts given by travellers in Egypt of the diseased condition of the eyes of the Egyptian beggars, particularly of babies and children, from the irritation caused by flies. The prevalence of ophthalmic troubles would suggest the frequent spread of these diseases by flies, the infection being carried from person to person.

As to the manner in which these sores are made Miss Ormerod says as follows: "Several other kinds of flies are very commonly to be found in our houses, including *Stomoxys calcitrans*, sometimes called the "stinging fly," which can give a painfully sharp prick by means of a needle-like proboscis. From these the house fly can be distinguished by its having not a sharp pricker, but a soft proboscis adapted for suction, but incapable of penetrating the skin, so that when these insects trouble man and animals it is only to imbibe their perspiration. But the various other flies which commonly pass under the name of "house flies" much resemble them in many particulars of their life-history, and speaking generally of these "flies" it is obvious that even of those which do not sting, where the foot has the "pads" covered with hundreds of hollow tubes secreting a viscid fluid by which they adhere to the smoothest surface, and the organs

used in taking food consist of minute formations called teeth by which the surface of the food is rasped, and thus new surfaces exposed to the action of the moisture of the fly's mouth, that it is not surprising that delicate parts, such as the surroundings of the eye, should suffer grievously, where, as in hot countries, they are buried under the constantly attacking masses of the pests."

Two simple devices are explained, one for catching flies, wasps, etc., out of doors in a wholesale way, the other for clearing a room in summer when flies frequently swarm into houses in annoying abundance. For the capture of flies in gardens Miss Ormerod advises the use of two square hand-lights, one set on the top of the other. The finger hole at the top of the lower one allows the flies to go up into the upper one, of which the hole is closed with moss or other material, and the lower one is raised up from the ground on bricks, with a bait of some attractive substance placed below. The flies after feeding rise up and gain access through the hole at the top to the upper light where they collect in thousands that soon die from the heat of the sun.

To keep flies out of dwelling houses Miss Ormerod tells of a plan contrived by her late sister, Miss Georgiana Ormerod. It is to close the lower sash of the window, then draw down the upper sash so as to open it about a foot at the top. Next draw down the calico rolling blind so that the flies are inclosed between the blind and the glass panes of the window, when, following their natural instinct, the flies rise, and when they arrive at the opening to the fresh air outside, out they all go.

A similar plan to the above has been practised in the dining-room of one of the hotels at Ottawa for some years, and has given great satisfaction.

LEAFAGE CATERPILLARS: In this chapter several leaf-eating caterpillars are treated of, together with the well tried insecticides, Paris green and kerosene emulsion. It is evident that through Miss Ormerod's instrumentality these valuable remedies are gradually becoming better known and more generally used by English orchardists.

MEDITERRANEAN FLOUR MOTH: We regret to read that this most injurious insect which was first noticed as mischievous in England in 1887, is now thoroughly established as a perfect pest in any roller flour mill where it once gets a footing, and also is to be found in bakeries, or the like places where the flour, on which its caterpillars feed, is present; and consequently now is in the course of unchecked spread, which has given the infestation thorough establishment. No new methods of treating the insect are spoken of; but an incidental mention is made to an important matter, *i.e.* the spoiling of flour by fumigating with sulphur, showing the necessity of knowledge and care in making use of this remedy. In Canada, even without any care on the part of millers, this infestation is of rare occurrence, the spread and increase of the insect over most of the Dominion being prevented or rendered easy of control by the low winter temperature, to which from time to time mills can be subjected.

ONION SICKNESS.—This attack due to the Stem Eel-worm (*Tylenchus devastatrix*) has never, so far as I am aware, been observed in Canada; but may at any time appear. The reasonable remedy proposed by Miss Ormerod should, however, be adopted for all vegetables showing disease. This is to destroy carefully by burning everything which shows a diseased growth, and on no account throw it on a manure pile to be put back again on to the land.

THE PEAR LYDA or Social Pear Saw-fly is of particular interest from the almost identical appearance and habits of the species with those of a Lyda found in great abundance last July in southern Manitoba on plum trees in the gardens of the Mennonites. Whole trees were seen, upon which nearly every leaf was seared and skeletonized. The foliage of large branches was frequently webbed tightly to the twigs, forming a tent containing scores of the curious false caterpillars. The remedy of spraying the trees early in June with Paris green would certainly have saved the trees.

PEAR AND CHERRY SAW FLY (*Eriocampa limacina*).—The Pear slug every year does much harm in Canada. This is almost invariably from the fruit grower's neglect. These caterpillars can be easily controlled by spraying or dusting with Paris green.

Surface Caterpillars (the cutworms of this country) did much damage in 1896. The chief point of interest is a trial of a mixture of nitrate of soda and salt (proportions not given) hand sown after hoeing between the rows and between the roots—at the rate of about 3 cwt. per acre. The results of the trial seem to justify a further test of this remedy which at any rate would invigorate and help the remaining plants to make a vigorous growth.

Caddis Worms were troublesome in beds of watercress and did considerable damage. This plant is cultivated in shallow canals with running water and is grown in large quantities to supply the city markets. The foliage is destroyed by the encased larvæ of several species of water flies which crawl nimbly about the plants. The most successful remedy was found to be to flood the beds deeply and then disturb the Caddis worms by passing the backs of wooden rakes very thoroughly over the plants. The worms let go their hold of the plants and rise to the top of the water and are carried off down the stream past the beds.

The above brief references are merely to those articles in this valuable report which are thought to be of direct interest to us; but there are many other subjects treated which may at any time demand our attention. The great charm of Miss Ormerod's reports is that she does not theorize and when reading them there is always an overwhelming feeling of confidence that any observation or investigation recorded is put down absolutely as she saw it.

J. Fletcher.

The Rev. Thomas W. Fyles, F.L.S.

We have much pleasure in presenting to our readers the excellent portrait of our colleague, the Rev. Thomas W. Fyles, who has been for many years an active member of the Entomological Society of Ontario. Though living at South Quebec, he has regularly attended the annual meetings at London, travelling many hundreds of miles in order to do so, and has invariably delighted those present with his excellent papers. He was a member of the Council from 1882 to 1888, when the change in the Act of Incorporation required the directors to be resident within certain districts of the Province of Ontario. Three times he has represented the Society as their delegate to the Royal Society of Canada at Ottawa, and he has been a member of the Editing Committee of the *Canadian Entomologist* since 1889.

While filling the arduous position of Chaplain to the immigrants landing in Canada, under the auspices of the Society for Promoting Christian Knowledge, he devotes any spare moments that he can get to the study of entomology. He has succeeded, with an energy and enthusiasm worthy of admiration, in forming an extensive collection of insects and acquiring a knowledge of the science beyond what is ordinarily met with. That he may long continue to carry on his excellent work, both in his official position and in his scientific pursuits, is the hearty wish of all his friends.

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Fordyce Grinnell

TWENTY-EIGHTH ANNUAL REPORT

OF THE

ENTOMOLOGICAL SOCIETY

OF

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1897.

(PUBLISHED BY THE ONTARIO DEPARTMENT OF AGRICULTURE, TORONTO)

BY ORDER OF

THE LEGISLATIVE ASSEMBLY OF ONTARIO.

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Dominion Entomologist and Botanist, President of the Entomological Society of Ontario, 1886-88.

Library of the Entomological Society of Ontario, London, Ont.

TWENTY-EIGHTH ANNUAL REPORT

OF THE

ENTOMOLOGICAL SOCIETY OF ONTARIO

1897.

To the Honorable John Dryden, Minister of Agriculture :

SIR,—I have the honour to transmit to you the twenty-eighth annual report of the Entomological Society of Ontario. It contains a full account of the proceedings at our thirty-fifth annual meeting, which was held in the City of London, on the 12th and 13th of October last, for the election of officers, the reading of papers and the transaction of the general business of the Society. The report includes the financial statement of the Treasurer and the reports of the various sections and departments of the Society, as well as the papers read and addresses delivered during the course of the meeting. Much attention was given to the alarming outbreak of the San Jose Scale insect in various parts of Ontario, and a valuable paper on the subject is included in this report.

The *Canadian Entomologist*, the monthly magazine issued by the Society, has now completed its twenty-ninth volume, and begun the publication of the thirtieth ; this is a record unequalled by any other monthly publication on entomology that has appeared in North America. The recently completed volume will be found to contain a large number of highly scientific and valuable papers contributed by the most eminent students of this department of science in Canada and elsewhere.

I have the honor to be, Sir,

Your obedient servant,

CHARLES J. S. BETHUNE,
Editor.

TRINITY COLLEGE SCHOOL,
PORT HOPE.

1 EN.

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ANNUAL MEETING OF THE ENTOMOLOGICAL SOCIETY OF ONTARIO, 1897.

The thirty-fifth annual meeting of the Entomological Society of Ontario was held in its new room in the Young Men's Christian Association Building, Wellington Street, London, on Tuesday and Wednesday, October 12th and 13th, 1897, the President, Mr. J. W. Dearness, of London, occupying the Chair.

The meeting was called to order at 2.30 p.m., on Tuesday, when the following members were present: Dr. James Fletcher and Mr. W. H Harrington, Ottawa; Mr. H. H. Lyman, Montreal; Rev. T. W. Fyles, Quebec; Mr. J. D. Evans, Trenton; Rev. C. J. S. Bethune, Port Hope; Mr. T. Hart, Woodstock; Messrs. W. E Saunders (Secretary), J. A. Balkwill (Treasurer), J. A. Moffat (Curator), J. H. Bowman, C. D. Anderson, and J. Law, London.

Letters of apology were read from Prof. Panton, of Guelph, who had been seriously ill for some weeks, and Mr. Arthur Gibson, of Toronto, regretting their inability to attend. The Chairman also reported that Mr. A. H. Kilman. of Ridgeway, one of the Directors of the Society, was ill in a hospital at Buffalo, N.Y.

The first paper was read by the Rev. T. W. Fyles on "An Arctian Larva—What is it?" and was illustrated by specimens of the moth from which the eggs were obtained and of some varieties of *Hyphantria cunea*. Dr. Fletcher, in commenting on the paper, said that Dr. Riley, in the Report of the Entomological Commission on Forest Insects, page 246, had figured ten varieties of this moth ranging from the common pure white, immaculate form to one profusely dotted with black and brown, and expressed his belief, founded upon the frequent breeding of specimens, that these are all varieties of one species, which should be known by Drury's name of *H. cunea* rather than *H. textor*, Harris.

Mr. Lyman said that this was an opposite case to that of *Euchætes collaris* and *egle*, which were supposed for a long time to be the same, but were found by breeding to be different species.

Mr. Lyman read a paper by Mr. Winn and himself entitled "Notes on Grapta Interrogationis," which will be published in the December number of "The Canadian Entomologist." This butterfly was very abundant about Montreal and other parts of the Province of Quebec during the season of 1896. Advantage was taken of this abundance by the authors of the paper to rear the insect from egg to imago in considerable numbers and in this way to settle some doubtful points in its life history. They described the various incidents that related to the rearing, egg-laying, duration of moults and of larval and pupal stages, emergence of the imago, etc. The larvæ were fed on elm and hop, in confinement and out-of-doors, and many in their natural condition were found to be severely parasitized. Out of one batch of 101 eggs laid by a single female, Mr. Lyman made a microscopical examination of fifty-two, and found that of these thirty-one had nine ribs and twenty one had ten. This year (1897) only one specimen of the butterfly was seen by Mr. Winn.

Mr. Fyles spoke of the former rarity of this butterfly in the Province of Quebec, and how for a few years it became fairly common, culminating in the remarkable abundance during 1896.

Dr. Fletcher drew attention to the fact observed by Mr. Lyman that the eggs laid by a single female had a variation in the number of ribs, though Mr. Scudder had supposed that each female would lay eggs with the same number of ribs, the number possibly varying with different individuals. The ordinary food plant is the elm, but it feeds also on nettle as well as hop. He found that the butterflies of the Vanessa group were very variable as regards the number of individuals from year to year. Sometimes *V. antiopa* was so abundant on the young elms at the Ottawa Experimental Farm that the larvæ had to be destroyed in order to save the trees.

Dr. Fletcher then brought up the subject of facilities for obtaining illustrations for "The Canadian Entomologist," and asked for information regarding cost, length of time required for execution, etc. Dr. Bethune in reply gave a full explanation of what was done regarding the many beautiful plates and excellent wood cuts that had appeared in the magazine during the last year or two, and pointed out the difference in the mode of preparing photo-gravures and process reproductions and their relative cost.

The meeting then adjourned till the evening, and the Council at once held a session for the transaction of business. The President remarked upon the removal of the Society's property since the last annual meeting to their new quarters, and the work done by the Curator in the moving. The local committee thought that some substantial expression of the Society's appreciation of the work that Mr. Moffat had performed should be made.

Mr. Balkwill said that there had been a great deal of extra labour involved in the moving, packing and unpacking of the cabinets and specimens, the taking down and rearranging of the library, etc., and that all had been done with so much care that no books or specimens were damaged in any way.

Mr. Fyles congratulated the members on their happy removal from the old building to the present cheerful room, and the escape from the beating of drums and other noises from the Salvation Army barracks below that often proved a serious annoyance. He thought that the thanks of the Council were fully due to the Curator, and that some substantial recognition of his careful work and extra labour should be made.

Dr. Fletcher concurred in the congratulations on the removal into so nice a room and into so fine a building, and he considered that the Society was under great obligation to Mr. Moffat for his unfailing kindness for many years to all the members of the Society in naming specimens and doing other work which could not be fairly said to be included in his duties.

Mr. Balkwill, in presenting the following resolution, said that the sum was not as large as he would like to see given, but he thought that it was all that the limited funds of the Society could afford. He then moved, seconded by Mr. W. E. Saunders, That the Council desire to place on record their appreciation of the services of the Curator, Mr. J. Alston Moffat, during the removal of the books and specimens from the former to the present room, and it is resolved that the sum of twenty-five dollars be given to Mr. Moffat in recognition of his labour on this occasion.—*Carried.*

The question of the heating of the room was next discussed, and it was then stated that it was inadequate in the autumn and early winter and again in the spring. The President was authorized to bring the matter before the officials of the Y. M. C. Association in order that the difficulty might be remedied, and also to sign and execute the lease.

Dr. Bethune drew attention to a suggestion of the President that each Director of the Society should be expected to make at the annual meeting a short report on the insects in his district which had been of special note during the season ; he thought it an admirable idea and one that if carried out would add much to the value and interest of the annual report. The suggestion was highly approved of by those present, and it was decided that it should be the duty of the Directors in future to make such reports

Mr. Fyles, at the request of Dr. Fletcher, gave an interesting account of the formation of the Quebec Branch of the Society, which was already so successful and numbered about five and twenty members

In the evening the Society held a public meeting in its new room on Wellington street, at which there was a largely increased attendance of members and friends In addition to those who were present during the day may be mentioned Messrs. H. P. Bock, B. Green, T. Green, R. W. Rennie, W. Scarrow, W. Percival, J. B. Spencer, W. Lochhead and Drs. Woolverton and Stevenson, London. The chair was taken by the President, Mr. Dearness, at 8 o'clock, and the meeting was opened by the reading of the report of the Council for the past year by the secretary, Mr. W. E. Saunders, which was on motion adopted.

REPORT OF COUNCIL.

The Council of the Entomological Society of Ontario have much pleasure in presenting the following report of their proceedings during the past year :

They have great gratification in stating that the work and influence of the Society have been much extended, and its membership increased by the formation of Branches in Toronto and Quebec. "The Toronto Entomological Society" was formed in February, 1896, with Mr. E. V. Rippon as president, and Mr. Arthur Gibson as secretary ; regular fortnightly meetings were held and much enthusiasm was displayed by the members. Towards the end of the year the desirability of affiliating with our Society was brought before the members, and after full deliberation it was decided to join us on the first of January, 1897, and to become a Branch of this incorporated Society in accordance with the terms of our constitution. A few months later another Branch of the Society was formed at Quebec through the exertions of our colleague, the Rev. T. W. Fyles, and twenty more names were added to our roll of membership. The old established Branch at Montreal is as vigorous as ever and continues to accomplish much good work. The Society has now four centres for holding regular meetings and promoting the welfare and extending the usefulness of the students of entomology in Canada. It is to be hoped that before long similar work may be carried on in the Maritime Provinces where little interest has yet been shown in this department of natural science, but where a great deal of important work could undoubtedly be done.

The twenty-seventh annual report on Economic and General Entomology was presented to the Minister of Agriculture for Ontario in December last, and was printed and distributed in the beginning of May. It contained one hundred and twenty-seven pages and was illustrated with one hundred and three wood cuts and six full page plates. With the exception of the first report (1870) it was the largest volume yet issued by the Society and contained more illustrations than any previous one. In addition to an account of the proceedings at the last annual meeting, the report contains the annual address of the president, Mr. John Dearness, and the following interesting and important papers : "Some insectivorous Mammals," by Mr. Robert Elliott ; "Notes on the Season of 1896," by Messrs. Fyles, Fletcher, Bethune, Moffat and Gibson ; "Entomology for Rural Schools," and "Two Insect pests of 1896," (the Army-worm and Tussock moth) by Prof. Panton ; "The importance of Entomological Studies to an Agricultural and Fruit-Growing Community," and "Lepidopterous Pests of the Meadow and the Lawn," by the Rev. T. W. Fyles ; "Some beetles occurring upon Beech," by Mr. W. H. Harrington ; "The San Jose Scale" and "Warning Colours, protective mimicry and protective coloration," by Prof. F. M Webster.

The Canadian Entomologist, the monthly magazine published by the Society, completed its twenty-eighth volume in December last. Ten numbers of the twenty-ninth volume have now been issued ; they contain 248 pages and are illustrated with eight full page plates, several of them of great beauty, and a number of original wood cuts. Among the many valuable papers published may be mentioned the continuation of the series of illustrated articles on the Coleoptera of Canada, by Prof. H. F. Wickham, which are most useful to students of this order, and are specially designed to be of assistance to beginners of the study of our beetles. It is with profound regret that the Council have learnt from Prof. Wickham that he is obliged to abandon the study of systematic entomology on account of trouble with his eyes, and they desire to express their deep sympathy with him in this affliction which so seriously interferes with his valuable and important work.

A number of interesting specimens of moths new to the Canadian lists have been added to the Society's collection by the kindness of Mr. J. Rice who has been a diligent collector at the electric lights in the city of London.

In the latter part of November, 1896, the Society removed its head quarters from the rooms it had occupied for over sixteen years in Victoria Hall on Clarence street to more accessible, commodious and better lighted premises in the Young Men's Christian Association fine new building on Wellington street. The cases of books and insects were

safely and conveniently installed without loss or injury under the careful management of the curator, Mr. J. Alston Moffat. In the new rooms the Council believe that the valuable property of the Society will be safer from fire and more easily reached by the members and the public. (See Plate 2 which shows a part of the Library.)

The Librarian's report will show that a large number of volumes of scientific Societies publications and pamphlets have been bound and placed for consultation on the shelves. The "Canadian Entomologist" is exchanged for the proceedings of various scientific and learned societies in all parts of the world. The number of such exchanges at present on the list is 74.

The Council desires to express its entire satisfaction with the efficient manner in which the curator, Mr. J. Alston Moffatt continues to discharge his duties.

The Treasurer's report shows that the finances of the Society are in a very satisfactory condition. While the expenses have been necessarily increased, owing to the change of rooms and the cost of removal, the balance on hand will no doubt be sufficient to provide for the expenditure that will be required during the remainder of the year.

The reports of the Secretaries of the several scientific sections of the Society, printed elsewhere, show that they continue to hold regular meetings and to accomplish much useful work.

The Society was represented at the meeting of the Royal Society of Canada, held at Halifax, Nova Scotia, in the month of June last, by Mr. J. D. Evans, of Trenton, whose report is published herewith. At the meeting of the British Association for the Advancement of Science, held in Toronto in August, the Society was represented by the president, Mr. J. Dearness, and the editor, Dr. Bethune, and was attended by several other of the members.

All of which is respectfully submitted.

LONDON, October 12, 1897.

JOHN DEARNESS,
President.

REPORT OF THE MONTREAL BRANCH.

The 207th regular and 24th annual meeting of the Montreal Branch of the Entomological Society of Ontario was held in the rooms of the Natural History Society of Montreal on 25th May.

The following members were present: Messrs. H. H. Lyman, President; A. F. Winn, Vice-President; G. C. Dunlop, T. Dwight Brainerd, A. Griffin, J. B. Williams, E. A. Norris, H. T. Pye, L. Reford, C. Stevenson, G. A. Moore and L. Gibb, Sec.-Treas.

The chair was taken by the President and the minutes of the previous regular meeting were read and confirmed, and the minutes of the last annual meeting were also read.

The President then submitted the following report of the Council for the past year:

REPORT OF COUNCIL.

In presenting their twenty-fourth annual report the Council have much pleasure in referring to the continued prosperity of the Branch.

Since our last annual meeting two new members have been added to our roll, but two others have resigned and we have also to deplore the loss by death of Mr. George Kearley, whose genial disposition and interest in the Branch and its work had won our high esteem.

During the year eight meetings have been held, at one of which we had the pleasure of the attendance of the Rev. Dr. Bethune, whom our members had thus the pleasure of meeting for the first time, and the following papers and communications were read:

Annual address of the President. H. H. Lyman.

Nasturtium as a food plant of Pieris Rapæ. A. F. Winn.

Description of two remarkable aberrations of Colias Philodice. J. D. Brainerd.

Address on the past season. Rev. Dr. Bethune.

The Crambidæ of the Province of Quebec. Rev. T. W. Fyles.

Notes on Grapta Interrogationis. A. F. Winn.

Notes on Grapta Interrogationis. H. H. Lyman.

A novel breeding cage. E. A. Norris.

Butterfly books. H. H. Lyman.

Description of the larva and pupa of Aulax Nabali. Rev. T. W. Fyles.

Notes on the past season of 1896 at Edgarstown, Mass. T. D. Brainerd.

Notes on Colias Cæsonia. Sent by T. E. Bean.

Notes on the occurrence of Thyatira Rectangulata in Canada. A. F. Winn.

Notes on the season of 1896. H. H. Lyman.

During the season several of our members again co-operated with the Natural History Society in continuing the course of short lectures to young people, on Saturday afternoons, with, it is believed, encouraging results.

Greetings have been exchanged with the newly formed Toronto Branch and we rejoice to learn that another branch has been formed in this Province, in the ancient City of Quebec, where a branch formerly flourished.

The Treasurer's report shows that the finances of the Branch are in a satisfactory condition.

Respectfully submitted on behalf of the Council.

H. H. LYMAN,
President.

The Treasurer then submitted his report, which showed an accumulated balance on hand of $35.46.

Upon the motion of Mr. G. C. Dunlop, seconded by Mr. C. Stevenson, the reports of the Council and Treasurer were received and adopted.

The President then read his annual address, giving a resume of the past year's work and pointing out a few lines for future guidance.

Some discussion then took place upon the suggestion to obtain a cabinet for a general collection for the Branch, the matter being finally left in the hands of the incoming council.

The following officers were then elected for the ensuing year:

President—HENRY H. LYMAN.

Vice-President—A. F. WINN.

Secretary-Treasurer—LACHLAN GIBB.

Council—G. C. DUNLOP and T. DWIGHT BRAINERD.

The meeting then adjourned.

LACHLAN GIBB.
Secretary-Treasurer.

REPORT OF THE QUEBEC BRANCH.

The Quebec Branch of the Entomological Society of Ontario came into existance at the close of a course of lectures on natural science given in Morrin College during the winter of 1896-97.

It was thought desirable that an interest in entomological and botanical pursuits should be continued during the summer vacation and to promote this interest the formation of an Entomological Association was determined upon.

At a meeting held in Morrin College on Wednesday, April 7th, and presided over by Reverend Principal Macrae, M.A., D.D., a constitution was adopted, officers were chosen and a resolution asking for recognition by the Ontario Society was agreed upon.

The following is the list of officers :

President—REV. PROFESSOR FYLES.

Vice-President—MISS MACDONALD, Principal of the Quebec Girls' High School.

Secretary-Treasurer—LIEUT -COL. CRAWFORD LINDSAY.

Council—MESSRS. J. GEGGIE, RICHARD TURNER and J. EVELEIGH TREFFRY : The MISSES BICKELL and B. WINFIELD.

On the 10th of May, the members met at the house of the President to examine his extensive collections. On this occasion the equipments necessary for a working entomologist were examined, and the methods of capturing, preserving and mounting insects were noted.

A field day was held at the "Gomin" on June 12th, when a number of rare specimens were taken. The presence and help of Messrs. Winn and Brainerd, of the Montreal Branch, added greatly to the day's enjoyment.

After the summer holidays, the members again met to compare and identify specimens. The President gave an address on the condition of the insect world in the winter months ; and Professor Walters one on "Entomological Experiences at Bourg Louis." *Colias interior*, *Terias lisa*, *Phyciodes Harrisii* and other rare insects were taken by Mr. Walters at that place.

By kind permission of the authorities of Morrin College, the members of the Branch enjoy the privilege of holding their regular meetings in the College Buildings and of attending the College lectures on natural history.

W. A. CRAWFORD LINDSAY,
Secretary-Treasurer.

REPORT OF THE TORONTO BRANCH.

The first annual general meeting of the Toronto branch was held in the Society's room, 451 Parliament street, on Friday evening, the 2nd April, 1897.

The following members were present : E. V. Rippon, President ; Arthur Gibson, Secretary-Treasurer ; T. G. Priddey, Librarian-Curator ; C. T. Hills, R. J. Crew, C. H. Tyers, J. H. McDunnough, H. S. Austen, Arthur Cherry and H. D. Chipman.

The Secretary read the following report of the Council, which was duly adopted :

REPORT OF COUNCIL.

The Council of the Toronto branch of the Entomological Society of Ontario take pleasure in presenting the following report of the proceedings of the Society during the past year.

While the membership of the Society has not increased to any great extent, yet the Council feel that the first year of the Society's existence has been a success. Since organization eight new members have been added to the roll. Of these eight, five have severed their connection with the Society, while the other three are still interested in its welfare. The membership now numbers twelve, and the council have every reason to hope that these figures will be increased during the coming year.

A most important event in connection with the Society was the affiliation of the Toronto Entomological Society with the Entomological Society of Ontario. This affiliation took place on the 1st January last, since which date the Society has been known as the Toronto Branch of the Entomological Society of Ontario.

During the past year twenty-four ordinary meetings have been held, and the following list of papers, contributed by the members, added much to their success:

March 6th, 1896.—The Classification of Insects, by Mr. T. G. Priddey.

March 20th, 1896.—A Few Notes on Coleoptera, by Mr. R. J. Crew.

April 2nd, 1896.—The Sphingidae, or Hawk Moths, by Mr. Arthur Gibson.

April 17th, 1896.—Notes on the ova of Lepidoptera, by Mr. C. T. Hills.

May 1st, 1896.—A new species of Diptera, belonging to the Genus Diopsis, by Mr. E V. Rippon.

May 15th, 1896.—Mysteries of Insect Life, by Mr. T. G. Priddey.

September 18th, 1896.—Notes on Toronto Sphingidae, by Mr. J. H. McDunnough.

October 2nd, 1896.—Notes on Collecting Coleoptera, by Mr. R. J. Crew.

December 4th, 1896.—Injurious Insects, by Mr. C. H. Tyers.

January 8th, 1897.—Sense of Sight in Insects, by Mr. S. R. Carter.

February 5th, 1897.—The Uses of Insects, by Mr. Arthur Gibson.

March 5th, 1897.—Obnoxious Insects, by Mr. T. G. Priddey.

The number of volumes in the library at the present date is forty-six, besides some fifty-two pamphlets, Government bulletins, etc., all relating to Entomology, and all of which have been kindly donated to the Society during the past year.

Considerable work has been done on the Society's collection of insects, especially during the last few months, and through the kindness of the members in presenting specimens, a fair number of insects are now in the Society's possession.

The Treasurer's report shows that the finances are in a satisfactory condition. Among the expenditure will be noticed that a considerable sum has been spent in the purchase of chairs, cases, etc., and also for rent of room.

Respectfully submitted on behalf of the Council.

E. V. Rippon,
President.

The reports of the Treasurer and Curator-Librarian were submitted and on motion duly adopted as read.

The election of officers for the ensuing year resulted as follows:

President.—E. V. Rippon.

Vice-President.—R. J. Crew.

Secretary-Treasurer.—Arthur Gibson.

Curator-Librarian.—T. G. Priddey.

Council.—C. T. Hills and C. H. Tyers.

The President then addressed the meeting, and in the course of his remarks congratulated the members on the work done during the year, and felt certain that the first year of the Society's existence had been a success. During the coming season he

hoped that each member would take a special interest in some particular species, working out the life history of at least one insect, and also that considerable time would be spent in the study of those insects which are beneficial or injurious to mankind. In the United States particularly economic entomology is making great strides, and Mr. Rippon advised the members to give particular attention during the coming season to those insects which are known to be injurious. Concluding, Mr. Rippon thanked the members for the honor conferred upon him in re-electing him to the position of President for the ensuing year.

The meeting then adjourned.

ARTHUR GIBSON,
Secretary.

REPORT OF THE BOTANICAL SECTION.

The Botanical Section organized in April.

A paper, illustrated with a fine series of examples, on Narcissus was presented by Mr. J. B. Bond.

One evening was devoted to Prof. Bailey's work on Plant Breeding, led by Mr. Dearness.

Another interesting paper by Mr. Bond on Iris afforded material for an evening's profitable discussion.

The other meetings were more or less informal and were occupied by examining and discussing specimens brought by the members.

Additions to the local flora were Draba Caroliniana, Anthemis arvensis, and Specularia perfoliata. Messrs. Bowman, Dearness, Elliott and Balkwill were the chief collectors.

J. B. BOND, Chairman.
ELLIOTT RICHMOND, Secretary.

REPORT OF THE GEOLOGICAL SECTION.

The Section in Geology beg to submit their annual report as follows :—

The meetings have been held weekly throughout the year with the exception of six weeks in midsummer.

During this interval several of our members made holiday excursions to various parts of our country, for the collection of material, and gaining useful information on subjects pertaining to our branch of science.

We have extended our trips to a greater distance from home than usual.

Mr. George Kirke spent several weeks in the northwest mineral regions in the vicinity of Rossland.

Mr. Brown spent five or six months prospecting on the north shore of Lake Superior and in the Wabigoon district.

Mr. A. Blackburn has been opening mines in the Lake of the Woods district.

Dr. Woolverton, chairman of the Section, has lately returned from collecting minerals from the north Hastings gold fields.

This shows great activity on the part of our members, and a determination to become better acquainted with the mineral resources of our country.

Our removal to the present room provided by the parent society, has not given us, as we anticipated, any more room for the display of specimens pertaining to our particular section. In other respects it is all that could be desired.

Many specimens of ores have been received, and placed upon the table, from various mining locations throughout the country, and we are pleased to learn that a large collection of minerals and ores from British Columbia has lately been sent, as a gift to our Public Library collection, to which our members will have free access.

The subjects studied during the year were various.

We reported to the local papers the find of coal or anthraxolite in the vicinity of Sudbury. Its value as a fuel has not yet been definitely settled by geologists.

We received the borings of various wells put down for oil in the vicinity of London, viz.:—Delaware, Parkhill and Mount Brydges, only a slight trace of oil being met with so far, showing that they are not within the true oil belt.

The Section has been materially assisted by donations of some of the products of the factories at Niagara Falls—resulting from the great electrical power now generated at that point.

Dr. Hough, a resident of that place, sent a small box containing carbide of calcium from which is made acetylene gas, which is likely to prove of some importance in the near future.

We also obtained from the proprietor of the carborundum works, fine specimens of this material, which, in hardness exceeds anything in nature or art except the diamond. This may be called the first step in the manufacturing of diamonds.

By vote of the Section the chairman was asked to attend the meeting of the British Association for the Advancement of Science at Toronto and report thereon, which was satisfactorily carried out.

Papers were read by the following members of the Section:

I. Dr. Wilson.

II. Mr. Geo. Kirke.

III. Mr. Goodburn.

IV. Mr. John Law.

V. Mr. D. G. Buchanan.

Steps are being taken to establish a public collection as a necleus for a museum in our Public Library.

Our members are ready to assist in carrying out the project to a successful issue as this would assist them in their work and also widen the sphere of influence in the Geological Section.

Submitted on behalf of the Section.

S. WOOLVERTON, Chairman.
JOHN LAW, Secretary.

A large and very handsome specimen of carborundum was exhibited to the meeting by Dr. Woolverton, who procured it from the works at Niagara Falls.

REPORT OF THE MICROSCOPICAL SECTION.

During the past season, meetings were held every two weeks after the opening meeting, until the close of the term in March. The average attendance was eight members. In addition to these meetings the Entomological Society kept open house on the first of January, 1897, this being the formal opening of the Y. M. C. A. building, in which the Society's new rooms are located, and on this occasion one of the principal attractions was the exhibit of microscopic objects by the members of this Section, and much interest was shown by the numerous visitors in the display. Eight or nine members took part, and the rooms were kept open all day as well as in the evening.

Among the papers read at the meetings of this year were the following: A Study of Lichens, by Prof. John Dearness; a subsequent evening being devoted to the practical handling, examination, and the mounting of these interesting plants, under the direction of the same gentleman.

The Growth of Ferns, by Wm. Lochhead, M.A., illustrated by blackboard drawings and figures drawn by the speaker from microscopic mounts.

Observations on microscopic and other forms noted during a recent trip across the Continent, by W. E. Saunders; illustrated by specimens of interest in various branches of natural life.

Microscopic Manipulation, by R. W. Rennie, illustrated by beautiful pieces of apparatus made by the speaker. The attendance and interest in the meetings were good, and on the whole, the Section looks back on a fairly satisfactory year.

J. H. Bowman, Secretary.

REPORT FROM THE ENTOMOLOGICAL SOCIETY OF ONTARIO TO THE ROYAL SOCIETY OF CANADA.

Having been chosen as the Delegate to represent the Entomological Society of Ontario on this most interesting occasion, the commemoration of the landing of Cabot, it becomes my privilege to submit a report of its work and proceedings during the past year.

The membership of the Society I am pleased to report has been well maintained and in addition thereto it is very gratifying to be able to say that on or about the opening of the current year a branch of this Society was inaugurated in Toronto by the affiliation of the Local Society formed about a year before, thus starting out with quite a considerable membership and manifesting much enthusiasm under the new regime.

The additions to the library were quite important including, among others, a full set of the annals of the "Entomological Society of France." The additional volumes, numbering ninteen, thus bringing the total library register up to 1,418 volumes.

There was also a limited addition to the collection of insects.

The official organ of the Society, "The Canadian Entomologist," still maintains its high standing among its class of literature. During the year 1896 it completed its twenty-eighth volume of 319 pages. Of the forty eight contributors thirty were from the United States, two from New Mexico, one from New Zealand, two from Europe, the remaining thirteen being Canadian. The contributors aggregated eighty-six articles, in some of which were described one hundred and eleven new species and four new genera.

Among the more important papers published during the year the following deserve particular mention.

The Coleoptera of Canada, by Prof. H. F. Wickham. These are a very useful series of illustrated articles for beginners as well as those more advanced. They were continued through five numbers and are a continuation of similar articles in two previous years.

The North American species of Gnathodus, by Mr. Carl F. Baker.

The American species of Isotoma, by Mr. Alex. D. MacGillivray.

Canadian Hymenoptera No. 7, by Mr. W. Hague Harrington, F.R.S.C.

A Contribution to the knowledge of North American Syrphidae, by Mr. W. D. Hunter.

Lepyrus, by John Hamilton, M.D.

The Cigar case-bearer of the Apple (Coleophora Fletcherella,) by Dr. Jas. Fletcher.

New American parasitic Cynipidae (Allotriinae), by Mr. Carl F. Baker.

The larger species of Argynnis and the mystery of their life history, by Mr. H. H Lyman, M.A.

On two interesting new genera of scale insect parasites, by Mr. L. O. Howard.

Index to the Mantidae of North America north of Mexico, by Mr. Samuel H. Scudder.

A summary of the members of the Genus Chilosia, Meig, in North America with descriptions of new species, by Mr. W. D. Hunter.

Some notes on Insect enemies of trees, by Mr. A. D. Hopkins.

Some new Nematids, by Mr. C. L. Marlatt.

Notes on the preparatory stages of Erebia Epipsodea, Butler, by Mr. H. H. Lyman, M.A.

A number of book notices, current publications of Entomological literature, correspondence, obituary notices, etc., also appear. At this time it will not be inopportune to mention the serious loss to the Society, from death, of two of its very active members, Mr. John M. Denton of London, and Captain J. Gamble Geddes, of Toronto.

The thirty-fourth Annual Meeting of the Society was held in its rooms, in London, on Wednesday and Thursday, the 21st and 22nd of October, 1896. A very full report of these proceedings is given in the Annual Report published by the Society (in addition to the Monthly Magazine) to the Department of Agriculture of the Province of Ontario.

This report consists of 127 pages replete with numerous illustrations. Two plates of these illustrations are worthy of particular mention as illustrating the study of economic entomology in the public schools, a work which should be heartily commended.

In addition to the report of the proceedings of the parent Society in which is embodied an extended and interesting Annual Address from the President, it contains also—

The reports of the Geological, Botanical, and Microscopical Sections of the Entomological Society.

The report of the Montreal branch with the annual address of its President.

And the report from the Entomological Society of Ontario to the Royal Society of Canada.

The following papers also appear in this annual report, viz.

Notes on the Season of 1896, by Rev. T. W. Fyles, F.L.S.

Some Insectivorous Mammals, by Mr. Robert Elliott.

Entomology for Rural Schools, by Prof. J. Hoyes Panton. Especially to be commended for the introduction and propagation of knowledge of economic Entomology among the children of both sexes.

The Importance of Entomological Studies to an Agricultural and Fruit-growing Community, by Rev. Thos. W. Fyles, F.L.S.

Two Insect Pests of 1896, by Prof. J. Hoyes Panton.

Notes on Insects of the Year 1896, by Rev. C. J. S. Bethune.

Insect Injuries to Ontario Crops in 1896, by Dr. Jas. Fletcher.

Some Beetles Occurring upon Beech, by Mr. W. Hague Harrington, F.R.S.C.

Notes on the Season of 1896, by Mr. J. Alston Moffat.

Warning Colours, Protective Mimicry, and Protective Coloration, by Prof. F. M. Webster.

The San Jose Scale, by Prof. F. M. Webster. A very exhaustive and valuable treatise on the subject.

Lepidopterous Pests of the Meadow and the Lawn, by Rev. T. W. Fyles, F.L.S.

Rare Captures During the Season of 1896, by Mr. Arthur Gibson.

The Butterflies of the Eastern Provinces of Canada, by Rev. C. J. S. Bethune.

The Geological Section reported that regular meetings were held weekly during the year with a fair attendance. Several places of geological interest had been visited by members and collections made. Valuable papers had been read, also four or five lectures given.

A collection of minerals having been presented by the Dominion Goxernment to the free library, which is accessible to our members, will be an incentive to more active work and increased membership.

The Botanical Section reported that the weekly meetings from the 1st May to the middle of July were well attended, several very pleasant outings had been held, and that the work of the year had been encouraging.

The Microscopical Section reported having had a year of continued success with fortnightly meetings from October 11th to April 17th, when its meetings were discontinued in favor of the Botanical Section. The subjects studied were arranged under ten different classifications, each led by a different member.

Each of the Sections above enumerated, as well as the parent society, look forward with anticipations of much greater usefulness and increase of membership upon occupying the new suite of rooms which have been secured and are now occupied.

The Montreal Branch presented its twenty-third annual report which showed a very marked increase in the membership. Eight meetings had been held during the course of the year at which ten excellent papers had been read, and the financial status was explained to be in a very healthy condition. The President's annual address was a very impressive one, urging upon the members to undertake and work up some special subjects among the very many open and now neglected, and enumerating a long list of such.

JOHN D. EVANS,
Delegate.

ANNUAL ADDRESS OF THE PRESIDENT.

BY JOHN DEARNESS, I.P.S., LONDON.

Members of the Entomological Society of Ontario :

LADIES AND GENTLEMEN,—It is my pleasant duty this evening to welcome you to the thirty-fifth annual meeting of the Society.

Since our last annual gathering our quarters have been removed from a room in the highest flat of the old Victoria Hall to these commodious and well lighted apartments in the beautiful new Y.M.C.A. Building. The removal of the cases, library, instruments, etc., a difficult matter, was well directed by the librarian, assisted by Mr. Balkwill. It was effected without accident or injury to the glazed cases or specimens. The librarian merits our commendation and thanks for the pleasing and convenient arrangement of the library, specimens and furniture of the Society in these rooms.

The year's work of the parent Society will be disclosed as the meeting progresses. Reports of branch societies and of the sections into which the members break up for the practical study of allied sciences will be presented by the respective officers. This year we shall have the pleasure for the first time of having reports from two new branches formed respectively in Quebec City and Toronto.

Last year we mourned the encroachment made by death in the ranks of our membership. At this meeting we are grateful that no name has thus to be taken off our roll, although our sympathies are called forth towards two of our directors who are unable to take part in the proceedings by reason of serious illness, viz., Mr. A. H. Kilman, director for the fourth division, and Professor Panton. We trust that God will bless the means employed to their speedy and complete recovery. Professor Panton's work last year was so helpful and acceptable that we miss him the more at this meeting.

THE INSECTS OF THE YEAR.

Fig. 1. Amputating brocade moth (*Hadena Arctica.*)

In 1895 a cut-worm moth (*Hadena Arctica*, Fig. 1) in prodigious numbers made housekeepers miserable in the evenings,—in the following spring the larvæ of the same insect did great injury to grain crops sown on ground which had been freshly broken out of sod. One might expect when the time of the pupation of these larvæ had expired to witness a reappearance of the moth in increased numbers. Such expectation was happily entirely disappointed. Every suitable acre of pasture ground or meadow was doubtless as thickly stocked with the larvæ as those acres of spring grain referred to, many of which had to be re-sown. No parasite was reported on them. What became of them?

Fig. 2. Eggs, pupa and moth of the Army Worm (*Leucania unipuncta.*)

Fig. 3. Army Worm.

In 1896 the army-worm (Figs. 2 and 3) devastated grain fields in many townships of Ontario, as witness the dark patches of infested country shown in the map of the Province published on page 45 of our last report. To illustrate how numerous they were in one school section in my own division: a lady told me that coming along at the time when the army was migrating from a grain field on the east side of the road in search of forage farther west they were so thick on the road that the faster travellers were crawling over the others instead of seeking a way round, if, indeed one could be found, and that not knowing but that the procession might be of indefinite duration she was constrained to lift her skirts and pick her steps on tip-toe, even then very unwillingly stopping forever at every step the progress of some of the hungry marchers. The Province throughout its length and breadth was thus patched over with incalculable numbers of the army worm. True their predatory enemies, during the short season their larvæ were fair prey, waxed fat and multiplied on them. The red-tailed Tachina, or possibly the yellow-tailed one, Fig. 4, adorned many a neck with one or two pretty eggs, but notwithstanding the great losses from these and other causes the one-spotted Leucania was the most common moth to be seen in the fall even in townships where not a larva had been reported. Why was not the whole country overrun with this insect this year? The causes and conditions of the appearance and the still more curious disappearance of such insects as the amputating brocade (cut-worm) moth and army worm challenge and invite investigation.

Fig. 4. Tachina fly (*Nemoræa leucaniæ.*)

If the army worm had its "innings" last year, this year the San José Scale has had the lion's share of attention. It is to be earnestly hoped that we are more frightened than hurt, but I am truly thankful we are well frightened. So far as I know, Dr. Fletcher and Prof. Panton, the officers of the Ottawa and Guelph experiment stations, deserve the chief credit for sounding the alarm. One benefit from the scare is that it has led many people to discover what a scale-insect is and to learn that for years their fruit trees have been injured by the native or naturalized species of this class of insect. If the alarm perpetuates, as it appears to have started, a crusade against scale insects of all kinds much good will result. I have been sent or shown several things and asked whether they were the dreaded

scale. They were mostly the Oyster-shell Bark-louse, *Mytilaspis pomorum* (Fig. 5.) One or two I took to be the Scurfy Bark-louse (Fig. 6), others included the woolly aphis, insect eggs, and a species of lichen. Doubtless the experiment station officers could give a long list of similar inquiries. Attention being diverted to those minute insects the presence of the San José one will be the more promptly detected. The destructiveness of this scale and the expense and difficulty of killing it except by methods that endanger its host will, if a few more instances of its introduction from nurseries occur,

Fig. 5.
Oyster-shell
Bark-louse.

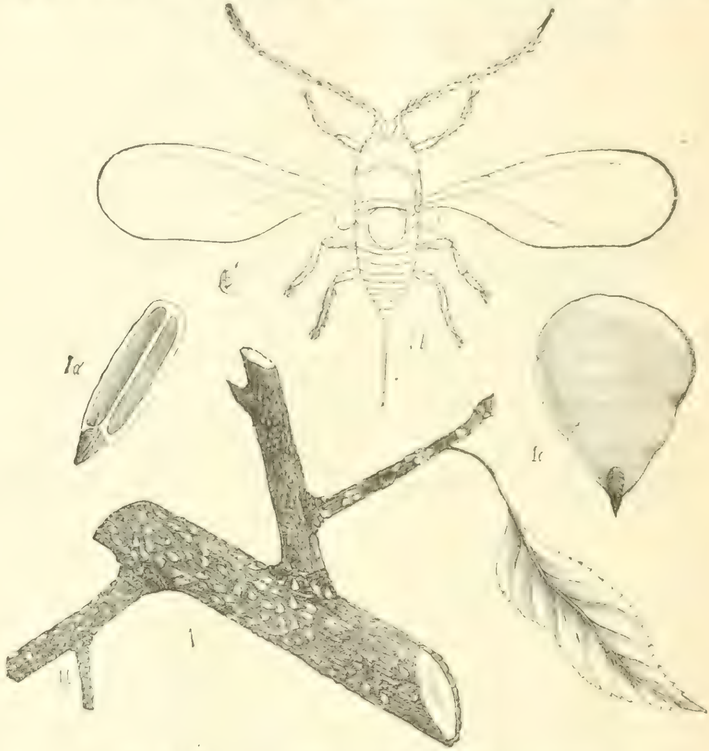

Fig. 6. The Scurfy Bark-louse (*Chionaspis furfurus*).

lead to legislation. I have met some people who had got the idea that there is a quarantine already established against nursery stock imported from abroad. Reports of the efforts to obtain such measures on the other side of the line have probably given rise to the impression. This meeting offers a fitting time and place to give an expression as to whether legislative action should be taken*

The San José Scale, if it ever becomes established in this country, will not, like the moths above referred to, be marked by sudden disappearance, nor will it, like the codling-moth or pear *Psylla*, confine its ravages to a single species of tree, nor even to trees under cultivation. Prof. Webster, of the Ohio Experiment Station, has pnblished a list of twenty two trees and shrubs upon which this scale has been found in his State. A list that includes plants with such dissimilar saps and cambiums as walnut, willow, elm, gooseberry, peach, grape, sumac and basswood may be extended to include almost every tree and shrub in the country. The State of Massachusetts has, within the past seven years, expended over $600,000 in its efforts to control and exterminate the gypsy moth, but no amount of money could effect the extermination of this destructive scale insect if it once got a foothold in a widely scattered number of our woodlands and orchards.

* In a late discussion Dr. Fletcher placed reliance for the suppression of this insect more upon the education and individual efforts of farmers and of fruit-growers than on legislation. Government might assist—as it is doing now through established agencies—but it would be most dangerous for the people to lapse into indifference owing to the belief that they are protected by an Act of Parliament against invasion by this scale insect.

In respect to protection, we have much to hope from the vigilance and energetic action of economic entomologists in the United States. In this connection much credit is due to Prof. Webster, of Wooster, for outspoken and manly denunciation of nursery companies he named who negligently contributed to the spread of this pest and of whose criminal negligence we have had a taste in Ontario. It was doubtless at his prompting that the Ohio Horticultural Society issued the call for the National Convention held in Washington last March to consider the suppression of insect pests and plant diseases by legislation. The proceedings of this convention served to direct attention to the dangers from imported insects that confront our fruit growers and to prepare the way for guaranteeing nursery stock and adopting other legislative preventives of the spread of pernicious insects and fungi.

Entomology in Schools.

It must have pleased the friends of scientific education who read the last annual report to observe that the teaching of entomology in the public schools occupied so large a share of attention.

The Western Fair Board this year repeated its offer of prizes for the life histories of injurious insects exhibited by schools. The prizes were won by Mr. J. W. Atkinson's

Fig. 7.—Pieris rapæ, male.

Fig. 8.—Pieris rapæ, female.

Fig. 9.—Pieris rapæ: *a*, caterpillar; *b*. chrysalis.

school, Avon P.O., and Miss Oorsaut's, No. 15, London Township. The former exhibited the cabbage butterfly, *Pieris Rapæ*, in egg, larvae (Fig. 9*a*) blown and in alcohol, pupa (Fig. 9*b*) and imagines of both sexes (Fig. 7 the male, Fig. 8 the female butterfly), pressed

Fig. 10.—Red-legged grasshopper.

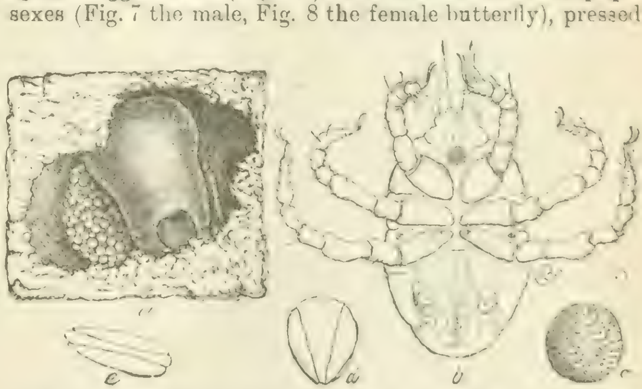

Fig. 11.—Trombidium Locustarum.—*a*, a female with her batch of eggs; *b*, newly hatched larva—natural size indicated by the dot within the circle on the right; *c*, egg; *d*, *e*, vacated shells (after Riley).

leaves showing the work of the larvæ, and a readable description of the insect and account of the observations made upon its life history.

Miss Corsaut's school exhibited a series of specimens of grasshoppers (Fig. 10) one or two with parasites attached, the red mite, *Trombidium locustarum* (Fig. 11), and a dissection of a locust.

It is to be hoped that an increasing number of county and township fair boards will follow the example of the Western in offering encouragement to the true study of insects in life. Collections of insects as commonly seen at county fairs have little claim to the honor of scientific exhibits. Their proper place is with wax flowers, rosettes of sea-weed, and other such pretty bric-a-brac. There is little scientific value in a collection of insects arranged at hap-hazard without notes and dates, be they ever so nicely spread. Economic interest in nine cases out of ten centres in the larval form of insects. Exhibits to be worthy of the name of science should attempt to show the phases of the life cycle, or at least something more than the mere capturing and preserving of a pretty object. The best prizes in the class ought to be offered for exhibits of complete representations of insects in their various stages. We should add to our extensive collections here such series of the more important economic insects, taking as a pattern this one of the gypsy moth* which shows so well the egg, larvæ, pupa and imago of that insect.

Du ing the year I received several inquiries from teachers near and remote asking suggestions in the matter of directing children in the practical study of insect life. Anticipating that in the future others may desire the information, I avail myself of the opportunity afforded by the printing and circulation of this report, to gratify the desire more fully and satisfactorily than I could do by letter.

At the outset the purpose of the lessons should be clearly defined in the teacher's mind. The aim should not be to fill the learner's memory with knowledge about insects but to train the young eye to see and the mind to reason about, to connect and relate the phenomena observed and to make these observations and reasonings the occasion for practice in correct expression by voice, pen and pencil.

The study, if natural, will be attractive to children. Flowers and insects are the classes of objects, next to mud pies, that they take most delight in. Now I recall Wordsworth's lines :—

"Oh ! pleasant, pleasant were the days,
The time, when, in our childish plays,
My sister Emmeline and I,
Together chased the butterfly !
A very hunter did I rush
Upon the prey :—with leaps and springs
I followed on from brake to brush
While she, God love her ! feared to brush
The dust from off its wings."

In a recent biographical sketch of that eminent training-school principal, Edward Austin Sheldon, of Oswego, by his talented daughter, there occurs this passage :—"This latter book (Harris's 'Insects Injurious to Vegetation,') was quite a classic with my father and me. We would sit in an unfurnished room of our unfinished house with the light burning so as to attract insects in at the open windows. We would soon have a delightful collection of moths, beetles and flies which we caught, killed, and then tried to determine by comparison with his book—an operation in which my father found me an enthusiastic rather than a valuable assistant. This keen and special interest in insects came about from the fact that my father's own work in the young training school was for some time zoology, and he saw that with the masses of children, insects gave one of the easiest and most inviting entrances to the whole domain of organic life. This idea, however, cost him much persecution and ridicule from those who could not understand the connection between grasshoppers and a well-educated child, not knowing grasshoppers very well themselves."

Each teacher will as skilfully as he can, introduce the study. Plans to arouse an easily obtained interest will readily suggest themselves.† The main points may be

* The speaker here exhibited a case received from the State Entomologist Fernald illustrating all the stages in the development of this destructive insect.

† Since writing the above I have received from Prof. Roberts, director of the College of Agriculture, Cornell University, Ithaca, N. Y., a series of seven "Teacher's Leaflets on Nature Study," entitled respectively : "How a squash plant gets out of the seed," How a candle burns, Four apple twigs, A children's garden, Some tent-makers, What is nature-study ? Hints on making collections of Insects. Some of the illustrations used in this paper are borrowed from leaflets Nos. 5 and 7. I can highly commend the series. The printer, W. F. Humphrey, Geneva, N. Y. is permitted to sell them to non-residents of the State at 5c. each or in large quantities at 1c. each. J. D.

illustrated by one or two examples and the technique rather than the methods may be described here. Take for example the cabbage butterfly, *Pieris Rapae* (figs. 7, 8 and 9) the study of which won the first prize above referred to. For a class beginning after midsummer holidays this insect is always easily obtained. Construct a cage by covering a box of horizontal cross section of from 40 to 100 square inches with mosquito netting or cheese

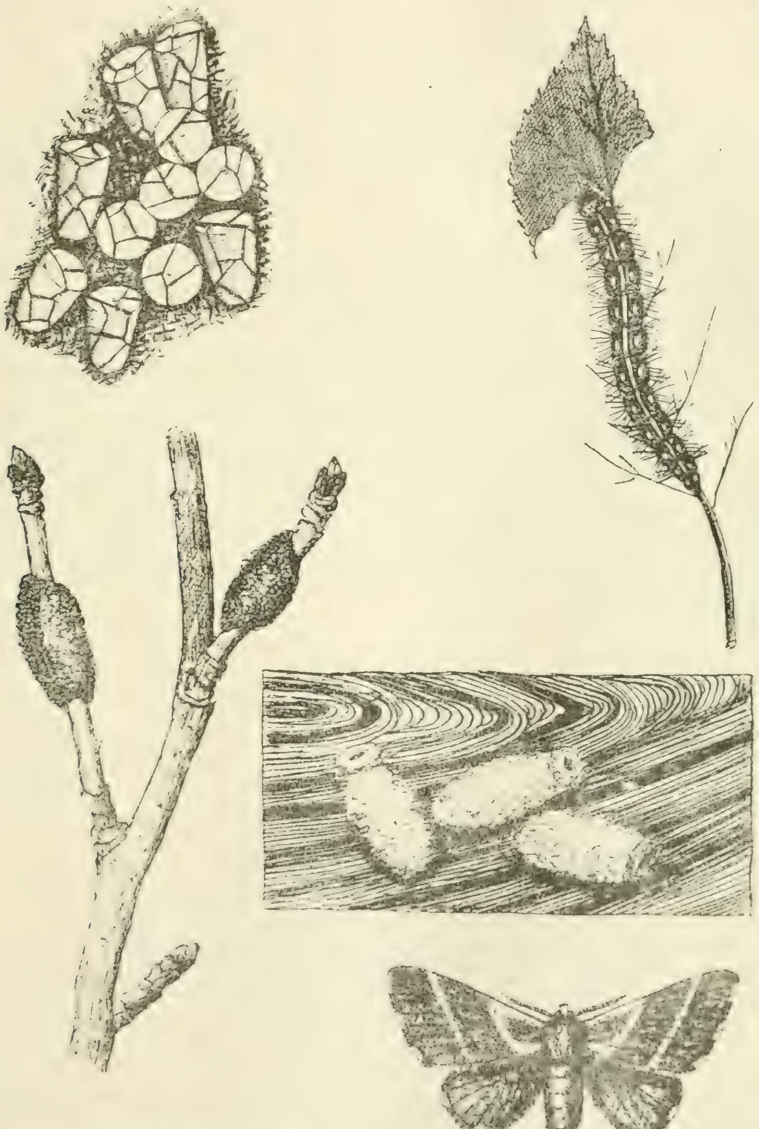

Fig. 12. Apple tree Tent Caterpillar (*Clisiocampa Americana Harris*). Two bracelets of eggs on apple twig. Eleven eggs enlarged. A full grown caterpillar. Three cocoons under a chip. Imago or moth. (After Anna B. Comstock in Teacher's Leaflet No. 5.)

cloth; or, being more convenient for feeding and studying, take an ordinary band-box, remove the bottom and substitute a netting or cheese-cloth covering. Use the latter to set over a smaller box such as a chalk-box. Many insects pass the pupal stage buried in the ground but chrysalids of butterflies are commonly found suspended in dry situations.

Earth to the depth of an inch may be put in the box and upon that some brushy twigs upon which to lay the leaves for food and chips to which the chrysalids may be attached. In the case of the cabbage worm, have the children collect the worms of various sizes and with them bring a leat or parts of leaves to serve as food. If the supply of food is maintained the larvæ will eat voraciously, grow fast, and in a few days prepare to transform into pupae or chrysalids. When these are formed, in the example under notice the box may be set away in the wood-shed or other secure cool place until the following spring awaiting the final transformation. Will you await the delightful surprise to discover to the children the connection between the beautiful white butterfly and the green cabbage-worm, (figs. 7, 8 and 9) or will you lead them to discover it when they are collecting and observing the larvæ? Circumstances will determine. You can and should stimulate a search for the youngest and smallest specimens. Some pair of sharp eyes may trace one to the egg, attached alone by its end to the under side of a cabbage leaf. Then institute a search for eggs, these will be brought in numbers and the hatching studied. It is needless to say you should have a magnifying lens; every teacher should have one.

In the spring the tent caterpillar is very suitable for study. It is no trouble in the beginning of the season to find a bracelet of varnished eggs encircling a twig of apple tree or wild cherry, (fig. 12) cut off the twig with another attached so as to form a fork that the newly hatched insects may weave a tent upon it. Set two or three of these forks in bottles of water, to stimulate the growth of the buds so that when the eggs are hatched the young tent-makers may have some leaves to feed upon. In time transfer them to the breeding cage with chips resting on the earth, under these chips they will spin their cocoons. These cocoons may be given to the children to watch during the holidays, for before the 1st of September the moths will have emerged. The conditions of growth in the school-room may be so unfavorable that healthy cocoons are not formed; supplement the supply by out-door captures. These two examples are selected out of many that might be taken. Nothing has been said of the important part of the study—observations on the habits, moulting, organs, mouth, antennæ, legs, segmentation, etc. These should all receive due attention.

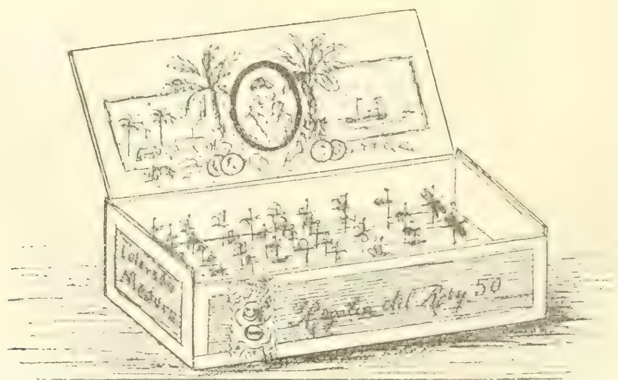

Fig. 13. In Teachers' Leaflet No. 7 (A. B. Comstock.)

When the moths are bred you may, if you wish, release them, but you may wish to preserve what represents a life history of the insect. Obtain a box 6 or 8 by 10 inches, 2 to 4 inches deep with a close wooden or glass cover, a cigar-box does very well for a beginning. (Fig. 13). Tack linoleum or cork in the bottom and then line the inside with white glazed paper. Two boxes similarly lined, hinged together, covered to resemble a large book and shutting very tightly are much used for insect cases.

The eggs are easily preserved. The leaf, twig, etc., may be pinned in the box, the eggs may be touched with coal oil to prevent hatching.

The larvæ are taken at various stages and killed with fumes referred to below or by dropping into hot water or into water and alcohol. They may be 'blown' as follows: snip off the anal end, empty by repeated gentle rollings with a lead-pencil from the head backwards, then blow up through a straw inserted in the opening, tie to keep the air in, and dry. Or they may be preserved in alcohol by putting them first into a 20 per cent. solution in water, the next day in a 40 or 50 per cent. solution, the next day into a 60 or 75 per cent. solution. They will keep indefinitely in a 75 per cent. or stronger solution. The more gradually the strength of the alcohol is raised the better the form and marking will be retained. If put at once into strong alcohol, soft bodied insects are shrivelled out of recognition.

Fig 14. Cyanide bottle (after Riley).

Frequently parasites may be discovered in or upon (living) insects. These should be carefully observed and specimens of them kept.

Butterflies and moths (*Lepidoptera* from *Lepis* a scale and *pteron* a wing, the wings being more or less covered with scales or microscopic feathers which give them their markings) whatever way captured, commonly with a net when in the open field, are transferred to a bottle or tin box and there killed with fumes of chloroform, ether, benzine, creosote, tobacco or cyanide of potassium. A cyanide bottle (Fig. 14) which should have a wide mouth and a tight cork, is prepared by dropping one or a few small lumps of cyanide of potassium, enough altogether to be as large as a marble, varying of course with the size of the bottle, pour over the lumps enough of a mixture of plaster of Paris and water of cream-like consistency to well cover the cyanide, or put in water enough to cover and add dry plaster of Paris enough to make a cement. Allow it to dry before corking. It is well to slip in strips of paper or a thin layer of cotton batting or discs of blotting paper or thin cork for the insects to rest on. Robertson's cyanide bottle described in the American Naturalist is constructed by putting some pieces of cyanide in a pill-box which can be inserted into the under side of the cork of the bottle or glued to it. The free side of the pill-box is perforated with pin holes. Keep tightly corked except when inserting or taking out an insect. To use chloroform, ether or benzine put a few drops on a bit of cotton batting and shut in box or bottle with the insect, or in like manner use a piece of cork saturated with creosote.

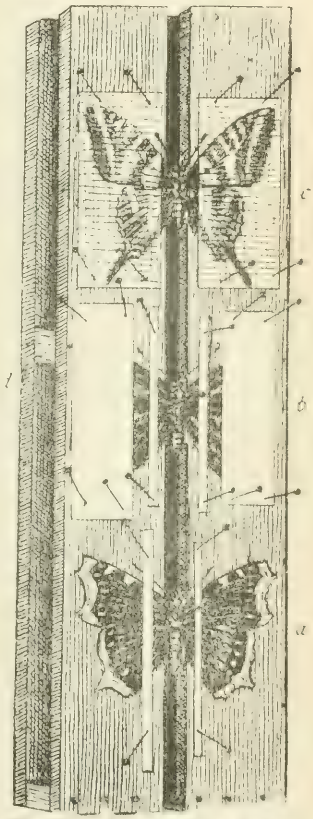

Fig. 15. A spreading board. The cleat *d* is one of two short ones that do not extend in far enough to interfere with the linoleum strip. Another should be shown at the upper end extending all the way across. (After Anna B. Comstock in Teacher's Leaflet No. 7: Coll. of Agric., Cornell Univ.).

After killing, lepidoptera are spread on a board until dry. The spreading is easily done before the insect becomes rigid. To make a spreading board (Fig. 15) take two pieces of smooth soft board one-third to one-half inch thick and ten to eighteen inches long by two or three inches wide, tack them a half inch apart at one end, a quarter inch at the other to cross cleats; below the opening tack an inch-wide strip of linoleum, corky side upwards, from cleat to cleat.

Insert a pin through the body of the killed insect just behind the head, stick the pin into the linoleum so that the insect's body will be carried down to the wings through the opening between the boards. Carefully, so as not to brush the "dust" off the wings expand them on the boards and over or across them pin narrow strips of paper (Fig. 16) to keep them in proper position until they dry. Two or three days will suffice for the drying. Beetles should be pinned through the right wing-cover (Fig. 17).

In the box we have spoken of nicely arrange the preserved material—eggs, larvæ

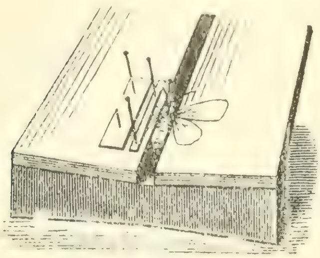

Fig. 16. Spreading board for butterflies and moths (after Riley).

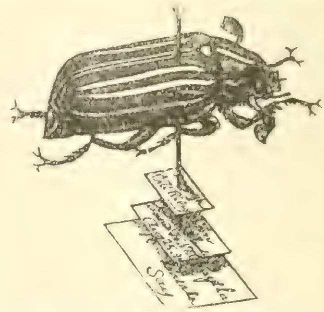

Fig. 17. Method of pinning and labelling beetles (after Riley).

dried or in vials of alcohol, parasites if any, pupæ, moths, or butterflies, etc. Photographic sketches of three such preparations were published in last year's report opposite p. 32. Keep living insects out, first by having boxes which close and stay tight, second by keeping in them a camphor ball or crystals of napthaline. Above all take good care of your accurately dated notes of observations. One such box as this the results of the teacher's and pupils' own efforts and investigations is likely to prove of greater educational and practical value than memorizing a whole text-book on entomology even though such study were supplemented by catching at random and mounting hundreds of beetles, moths and butterflies.

One of the most serious defects in our public school system of education is the lack of exercises that train children to observe and to reason from their own observations. Such kind of training cannot be obtained from text-books nor tested by examinations, and hence will the more slowly gain its proper place. But I hope that the influential efforts of this society, now that it has taken the subject up, will continue to stimulate and encourage nature study in our schools, at least along that line in which it is particularly interested which the quotation from Mr. Sheldon shows to be so appropriate and which is no less practical than disciplinary.

Mr. Fyles, in moving a vote of thanks to the President, expressed the pleasure experienced by all who were present in listening to the address; he found it most interesting and full of valuable lessons to all.

Dr. Fletcher seconded the motion and said that he thought all had enjoyed very much the presentation of the affairs of the year that Mr. Dearness had given. For himself he considered the remarks in the address singularly pertinent. No branch of science meant more in actual dollars to the people of the country than that of entomology. Of all the crops that we grow, whether in the field, the orchard or the garden, at least one-tenth was lost owing to the depredations of insects, and yet to-day fewer persons applied themselves to this study than to almost any other branch of science. The strange thing is that so little is done to instruct children regarding their insect friends and foes. The plan proposed by the President in his address—the study of practical entomology in the rural schools, is an admirable one, and yet nothing has hitherto been done in Ontario in this respect. In Manitoba the rural schools are much in advance of ours; there the children are taught some practical entomology and botany, and are rapidly coming to know the insects and weeds that are giving trouble, and to recognize common plants and other

objects. Children on the farm may, by a little instruction of this kind, save many false steps from being taken in the warfare against pernicious weeds and insects. Through his official correspondence he finds a vast amount of ignorance about these things that ought not to exist, and the only way to remedy it was by beginning with the young. He considered that the President's address was eminently practical and useful, because it treated of such common insects as the tent caterpillar and the cabbage butterfly. Knowledge such as this, if spread throughout the country schools, would mean the saving of hundreds of thousands of dollars. Take the San José Scale for instance, the most destructive insect yet known. How few persons could recognize it if they saw it! How few could tell it from the oyster-shell bark-louse! Who can answer the question as to its effect upon Canada? He believed that President Dearness was doing a great deal by this address, in spreading a knowledge of the work of this Society, and in popularizing the study of entomology. Turning to the reports of the Branches, which had been read, he drew attention to the fact that the Montreal Branch had held no less than 207 meetings, and of these probably 200 had been held in Mr. Lyman's own house, where he entertained the members and enabled them to make use of his valuable library and extensive collections. Few men had done such a good work for the science as this.

Dr. Bethune rose to put the vote of thanks to the meeting, and said that all present must highly appreciate the address of the President and heartily subscribe to the favourable comments which Dr. Fletcher had made upon it. He was glad to find that the President again took up the subject of teaching entomology in the rural schools, which he and Prof. Panton had brought before the annual meeting last year. It was satisfactory to learn that the Western Fair Association continued to offer prizes for the exhibition of life histories of insects by school children, and the good work presented showed that some of the schools at any rate appreciated the opportunity afforded them. With regard to the extraordinary disappearance of insects that were prevalent in immense numbers last year, he thought that there were two causes for their destruction, viz., the work of parasites and the very changeable weather during the winter. Mr. Moffat, last year, when the army worm was swarming all over the Province, predicted that we should not be troubled with it this year, and we all know how true his prophecy proved. We may ascribe its absence this year to the excessive mortality caused by its parasites and other natural enemies. Dr. Bethune then put to the meeting the motion for a hearty vote of thanks to the President for his excellent address, and pronounced it "carried" amid much applause.

The Rev. T. W. Fyles then read the following paper:

THE LOCUSTS OF THE BIBLE.

Rev. Thomas W. Fyles, F.L.S., South Quebec.

Solomon, the favoured of God, who lived in the golden age of Israelitish history, was renowned as a wise ruler, an enlightened philosopher, a gifted poet. He was moreover a distinguished naturalist, for it is told in his praise that "he spake of trees, from the cedar that is in Lebanon, even unto the hyssop that springeth out of the wall; he spake also of beasts, and of fowl and of creeping things, and of fishes."*

We may infer then that a knowledge of Natural history is not unbecoming in the man of position, the man of affairs, the gentleman, the scholar.

Such knowledge was needed in Solomon's days, for amongst the Baalim worshipped by the heathen around, and too often by Israel herself, was *Baalzebub*, the god of the flies, whose name was afterwards given to the Jewish devil. What bugbears have arisen in the minds of men ignorant of natural science!

Before Solomon's time the great Israelitish lawgiver, Moses, had paid much attention to the economic aspects of entomology, and by sacred writers in other periods of the history of God's ancient people thoughtful allusions, inculcating important lessons, were made to insect life and habits.

* I Kings iv. 33

In studying these references and their teaching, we have to encounter great difficulties arising from the fact that between the science of the ancients and that of our own day there is but little connection. Most of Solomon's wise sayings in natural history have passed into oblivion. The reasons for the discrimination made by Moses in regard to food are unknown. The treasury of Egyptian wisdom that he drew from is gone, and generally, we have to form conclusions from obscure meanings of obsolete terms, and from statements made in highly figurative language.

Moreover, we have to fit the information thus gathered to a fauna with which we are imperfectly acquainted, and which exists under changed circumstances, and may itself have undergone changes both by losses and accretions.

Among the insects most frequently mentioned in the Scriptures, the locusts take a leading place. They are sometimes called grasshoppers, and they are often associated with "the caterpillar and the palmer-worm." It is of this army I purpose now to treat.

And first, for the better understanding of my subject, it may be well for us to take a glance at the modern systematic arrangement in which locusts and grasshoppers appear.

Both are found in that large order of insects named the ORTHOPTERA from two Greek words *orthos*, straight ; *ptera*, wings. They are straight-winged insects.

By Westwood the Orthoptera were sub-divided into four groups which he named respectively *Cursoria, Graptoria, Ambulatoria* and *Saltatoria* ; into

Runners, like the Cockroach.

Graspers, like the Mantis.

Walkers, like the Spectre Insect.

Leapers, like the Locust and Grasshopper.

The locust and grasshopper then are leaping straight-winged insects.

To set before you the points of distinction between them, that have come to be recognized by Naturalists in our own day, I cannot do better than make two brief quotations from Harris, whose work on "Insects injurious to Vegetation" is one of our Entomological classics. He says :—

"Grasshoppers, properly so called, * * are those jumping orthopterous insects, which have four joints to all their feet, long bristle-formed antennæ, and in which the females are provided with a piercer, flattened at the sides, and somewhat resembling

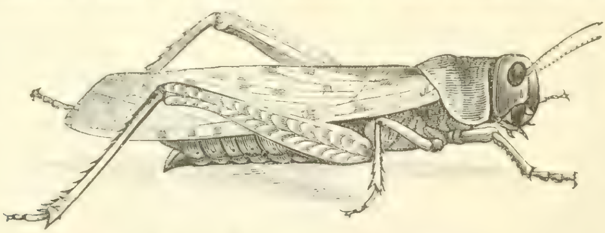

Fig. 18. A Grasshopper or Locust.

a sword or cimeter in shape. The wing-covers slope downwards at the sides of the body and overlap only a little on the top of the back near the thorax. This overlapping portion, which forms a long triangle, is traversed, in the males, by strong projecting veins, between which in many of them, are membranous spaces as transparent as glass. The sounds emitted by the males, and varying according to species, are produced by the friction of these overlapping portions together." *Ins. inj. to Veg.*, p. 155.

Again he says :—

"The various insects included under the name of locusts (Fig. 18) nearly all agree in having their wing covers rather long and narrow, and placed obliquely along the sides of the body, meeting, and even overlapping for a short distance, at their upper edges, which together form a ridge on the back like a sloping roof. Their antennæ are much shorter

than those of most grasshoppers, and do not taper towards the end, but are nearly of equal thickness at both extremities. Their feet have really only three joints; but as the under side of the first joint is marked by one or two cross lines, the feet, when seen only from below, seem to be four or five jointed. The females have not a long projecting piercer, like the " * * " grasshoppers, but the extremity of their body is provided with four short, wedge-like pieces placed in pairs above and below." * *

"The males, though capable of producing sounds, have not the cymbals and tabors of the crickets and grasshoppers; their instruments may rather be likened to violins, their hind legs being the bows and the projecting veins of their wing-covers the strings. *Ibid*, p. 165.

Between the grasshopper and the locust then there are well-marked differences in structure, and in their methods of producing musical notes. But these differences have come to be recognized by naturalists in very modern days.

By the English generally both kinds of insects are still called grasshoppers. If I had been asked when a boy to tell the differences between them, I should probably have said, the locusts are creatures that we read of in the Bible and books of travel; the grasshoppers are those long-legged fellows that spring up before you when you walk through the grass.

We learn from Kirby and Spence that it was reported that a cloud of grasshoppers had enveloped a ship when it was distant 200 miles from land. Here locusts were certainly meant, for grasshoppers (as *we* understand them) are incapable of long sustained flight. And Hasselquist quoted by the same authors tells of "locusts *or* grasshoppers."

I have no doubt that with the translators of our English Bible "grasshoppers" and "locusts" were synonymous terms. The Hebrew word *Arbeh* is translated by them, in some places (as in Exodus X, Proverbs XXX, 27) LOCUST, in others (as in Judges VI, 5 and Jeremiah XLVI, 23) GRASSHOPPERS. And in the Prayer Book version of the Psalms—a version retained from the "Great Bible" of A.D. 1540—the reference in Psalm CV, 34, to the Plague of Locusts in Egypt reads thus,—"He spake the word, and the grasshoppers came, and caterpillars innumerable: and did eat up all the grass in their land, and devoured the fruit of their ground."

Again, for the better understanding of my subject I will ask you to glance at the life history of the locust as it is known to us. It is very much the same in all lands.

The mother locust when about to deposit her eggs makes an opening in the earth about an inch deep, using her abdomen as a drill. The horny plates at the extremity of her body which she can bring to a point for the penetrating of the soil, and expand for the widening of the orifice made, enable her to work with facility. In the receptacle thus formed she lays a batch of eggs surrounding it with a frothy mucous which hardens into a protection against moisture. She then conceals the hole.

It is calculated that each female will deposit in the course of the season from 10 to 175 eggs.

In due time the young larvæ appear, and comical little fellows they are, largely made up of legs of which they have six. They are gregarious by instinct, and they have healthy appetites. They feed and grow, and cast off their skins when these become too tight for them—having more expansive ones beneath.

They have no wings; and when they march they take a few steps and then a jump,—a few steps and then a jump,—and so onwards. In Eastern lands where they abound, this mode of progression gives to their advancing multitudes a strangely undulatory and wave-like appearance.

With many kinds of insects the pupal state is a quiescent state—not so with the locusts. Their pupæ are both active and voracious. They cannot fly, but they bear the cases in which the wings of the future imagines are forming.

At length the time comes for the perfect insect to appear; the skin of the pupa splits along the back, and the imago extrudes itself, drawing its wings out of their cases, and

its legs from theirs as if it were drawing off its boots. In a few minutes it is fully developed, and is ready for feeding, for pairing and for flight.

Our largest Quebec locust, *Œdipoda Carolina*, Burm., measures about three inches and a quarter in expanse of wings. The *Œdipoda migratoria* of Palestine is double that in size. But it must not be forgotten that the locust plague of Egypt was a unique and miraculous visitation. We are expressly told that "Before them there were no such locusts as they, neither after them shall be such.' They came on an east wind that had blown for a day and a night. Traditions concerning them must have lingered long, and probably gained in the telling; and so it is not, perhaps, very strange that Pliny the elder should have heard of locusts from India that had a length of three feet and legs so set with spines that the women used them for hand-saws. Men in Pliny's time could doubtless "draw the long bow" and listen, *auribus patentibus*, to travellers' wonders. In our day we tell *bear* stories, *moose* stories and *fish* stories. It seems that in Pliny's day they told *locust* stories.

I have in my collection a locust from the tropics which has an expansion of wings of nine inches, and its legs are four inches long. This formidable insect is hard, warty, and crested like a lizard, and its wings are of a dark blood-red. Fancy creatures such as this descending in "numbers numberless"—darkening the sky—tumultuous—bewildering—beating in your face—clinging to your hair and clothing—writhing under your feet—whirring, clattering, gnawing all around you—devouring everything eatable, and then in the rage of hunger falling upon one another.

The scene is too horrible. Yet it is one that has been often witnessed. The Tartars tell of men smothered by locusts.* And but a few months ago it was stated that a French explorer had been overpowered by locusts, and when the swarm lifted and men came they found *a skeleton.*

The Hebrew word ARBEH which, as we have seen, is translated *locusts* or *grasshoppers*, originally signified *multitudinous.* It is translated in the Septuagint *akris*; in the Vulgate *locusta*, and in Suker's German Bible, *henschrecke.* In Judges, VI. 5, and in Jeremiah, XLVI., our English translators rendered it *grasshoppers.* It is generally believed to have been the *Œdipoda migratoria.* The *wandering* locust according to modern term—the *swarming* locust according to the ancient appellation.

It was my good fortune to see and to capture several specimens of this interesting insect when I was a boy. After long-prevailing south east winds, they had been brought, probably from Spain or Africa, to the east coast of England. Certainly I accounted it a noble creature, with its helmeted front and its wide-spreading, fan-like under-wings, which one might fancy to be formed of delicate green gauze. When it alighted its horny feet came down together with a clatter that was startling.

Another word is in frequent use in the Jewish Scriptures to denote locusts. It is CHAGAB, which is derived from a word that signifies to *veil* or *cover*—The swarms cover the earth and veil the sun. By our English translators Chagab is usually rendered *grasshoppers*; and in the connection in which it is employed it suggests the idea of *smallness*, as in Numbers XIII. 33: "And there we saw the giants, the sons of Anak, which came of the giants; and we were in our own sight as grasshoppers, and so we were in their sight." It became in the late Hebrew a collective name for the locust tribe (see Speaker's Commentary). It is thought to have been especially applied to the species *Acridium peregrinum.*

There is a third kind of locust quite common in the East, the *Acridium lineolum.*

One of the insects that the Israelites were allowed to take for food was the "Bald Locust" of our English Bible—the SALAM of the Hebrew. The latter term means *a consumer.* This insect is believed by Wood to have been a *Truxalis*, a kind of locusts with enlongated heads suggestive of baldness.

* Kirby and Spence's Entomology, Letter VII.

Besides those words translated *locust*, *bald locust* and *grasshopper*, in our versions, there are others variously rendered which are yet believed to have signified locusts, either of different kinds or in different stages of growth

CHARGOL, the "beetle" of Lev. XI. 21, 22, is believed to have been some kind of locust for it is numbered among the insects that "have legs above their feet to leap withal." In connection with this, Wood, in his Natural History of the Bible, expressed a belief that there are no people that eat beetles; but in this he was mistaken. Dr. Hartwig says :—

"The Goliath beetles of the coast of Guinea are roasted and eaten by the natives who, doubtless like many other savages, not knowing the value of that which they are eating, often make a *bonne bouche* of what an entomologist would most eagerly desire to preserve."—*Polar and Tropical Worlds*, p. 592.

Of words that are supposed to denote the locust in an immature state, we have:—

CHASTIL, *the devourer*, translated "caterpillar" in 1 Kings, VIII. 37, 2 Chron. VI 28; Psalm LXXVIII. 46; Isaiah XXXIII. 4; Joel I. 4, and II. 25.

YELEK, *the feeder*, translated "caterpillar" in Ps. CV. 34, and Jer. LI. 14 and 27; and *cankerworm* in Joel I. 4 and II. 25, and in Nahum III. 15, 16.

Dr. Thompson gives a graphic description of a procession of these "caterpillar locusts." He says :—

"Their number was astounding, the whole face of the mountain was black with them. On they came like a living deluge. We dug trenches and kindled fires, and beat and burned to death 'heaps upon heaps,' but the effort was utterly useless. Wave after wave *rolled up* the mountain side, and poured over rocks, walls, ditches and hedges—those behind covering up and bridging over the masses already killed. . . . It was perfectly appalling to watch the animated river as it flowed up the road and ascended the hill behind my house. . . . For four days they continued to pass on towards the east, and finally only a few stragglers were left."—*The Land and the Book*, p. 417.

This account will perhaps help us better to understand what is meant by "palmer-worm." In considering this a double difficulty faces us—the meaning of the original word GAZAM: the meaning of the English word *palmer-worm*. The latter certainly does not mean the *Ypsolophus pometellus*, Harris, of our Canadian lists.

GAZAM or GEZEM, the "gnawer," is rendered in the Septuagint *kampe* from *kampto*, to bend (as a caterpillar in motion). In the Vulgate it is translated *eruca*, and in the German *reupe*.

In Joel, I.: 4, we read "That which the palmer-worm (*gazam*) hath left the locust (*arbeh*) hath eaten" "Literally," says Pocock, "That which the *licking* (locust) hath left the devouring (locust) hath eaten."

The Seventy understood by GAZAM *something that progressed with undulations*.

The knowledge of the Eastern locusts and their ravages was no doubt spread amongst the English people by returned Crusaders and other pilgrims from the Holy Land. How would such men tell of a scene such as Dr. Thompson witnessed! They would probably speak of the immature locusts as caterpillars and describe their progressive movements as undulations. And the common people associating things described with things that were familiar to them would probably think of the devouring "processionary caterpillars"* of Europe which, like the "army-worm" of this continent, do incalculable injury.

At the close of the Crusades hordes of masterless, dissolute men, in passing through Europe on their return, must have devoured and wasted all they came upon, and yet were they proud of the cross and palm-branch, the tokens of their service. In irony, it may be—remembering the ravages of these men—the common people came to speak of

* *Cnethocampa processionea* and *Clisiocampa neustria*.

gregarious, wandering caterpillars as *palmer*-worms; and so the English translators found a word ready coined and well fitted to represent *gazam*, the "waster," in *kampe*, the "scuffler."

It is surprising what unsatisfactory definitions of such words as palmer worm are given even in dictionaries of some note. In the "Dictionarium Brittanicum of N. Baily ('Philologus')," printed by J. Cox in MDCCXXX, we find "Palmer-worm, *a caterpillar with many feet*." How many feet! Philologus seems to have thought that caterpillars had an indefinite number of such appendages. He evidently was not an entomologist. In "Reid's Etymological Dictionary" the explanation of palmer-worm is *a worm covered with hair*. What a wide field does this present for the student of languages to speculate in! He might say, Does the explanation denote a lizard, like the "slow-worm (*Anguis fragilis*)," but having a hirsute covering, or a serpent, like the "pretty worm of Nilus" that "kills and pains not."* or a true worm belonging to the Entozoa or the Lumbrici?

Perhaps the simplest accurate definition that can be given to "palmer worm" is *a wandering and destructive larva*. This would tally both with the English word and the original.

That locusts should abound in Palestine was natural. The inhabitants were a pastoral people. Around the cities were small tracts of cultivated land, but the country at large was wilderness. In the undisturbed soil the locusts would deposit their eggs in safety, and their progeny would grow and increase. The Francolin or Red Partridge might devour some of them; and dwellers in the wilderness like St. John the Baptist might make of them their bread, sweetening it with "honey out of the stony rock"; some of the insects might even be taken as delicacies for the feasts of kings, for in the British Museum is a sculptured scene of feasting brought from Nineveh, in which attendants are bearing locusts strung upon sticks in the manner that small birds were served in later times at the banquets of the Norman nobles. But such inroads would make but little impression upon their hosts, and at length they would arise in their strength—God's great army—directed by Him "who maketh the clouds His chariot and walketh upon the wings of the wind."†

Many stories are told of calamities brought by locusts. These are specimens, and they have a bearing upon what has already been said:

"From 1778 to 1780 the whole empire of Morocco was so laid waste by swarms of these insects that a dreadful famine ensued. Mr. Barrow, in his travels, states that in the southern parts of Africa the whole surface of the ground might literally be said to be covered with them for an area of nearly 2,000 square miles. When driven into the sea by a north-west wind, they formed upon the shore, for fifty miles, a bank three or four feet high; and when the wind was south-east the stench was such as to be smelt at the distance of 150 miles. Major Moore observed at Poonah an army of locusts which devastated the whole country of the Mahrattas, and most likely came from Arabia. Their columns extended in a width of five hundred miles and were so dense as to darken the light of the sun. It was a red species (not the common *Gryllus migratorius*), whose bloody color added to the terror of their appearance."—*The Polar and Tropical Worlds*, p. 589.

But no merely human account can approach the sublimity of the inspired description of a flight of locusts given by the prophet Joel—a description marvellous for the richness of its sustained metaphor and the splendor of its hyperbole.

The prophet sounds the alarm:

JOEL II.: 1. Blow ye the trumpet in Sion, and sound an alarm in my holy mountain: Let all the inhabitants of the land tremble: for the day of the Lord cometh: for it is nigh at hand.

2. A day of darkness and of gloominess, a day of clouds and of thick darkness, as the morning spread upon the mountains: a great people and a strong: there hath not been ever the like, neither shall be any more after it, even to the years of many generations.

* *Antony and Cleopatra*, Act V., Scene II. †Psalm CIV., 3.

Then he tells of the damage:

3. A fire devoureth before them: and behind them a flame burneth: the land is as the Garden of Eden before them, and behind them a desolate wilderness, yea, and nothing shall escape them.

He portrays the foe:

4. The appearance of them is as the appearance of horses: and as horsemen, so shall they run.

5. Like the noise of chariots on the tops of the mountains shall they leap, like the noise of a flame of fire that devoureth the stubble, a strong people set in battle array.

He speaks of the terror they excite:

6. Before their face the people shall be much pained: all faces shall gather blackness.

He describes the assault:

7. They shall run like mighty men: they shall climb the wall like men of war: and they shall march every one on his ways, and they shall not break their ranks:

8. Neither shall one thrust another: and they shall walk every one in his path: and when they fall upon the sword, they shall not be wounded.

9. They shall run to and fro in the city: they shall run upon the wall, they shall climb up upon the houses: they shall enter in at the window like a thief.

Then he recapitulates:

10. The earth shall quake before them: the heavens shall tremble: the sun and the moon shall be dark, and the stars shall withdraw their shining:

11. And the Lord shall utter His voice before His army: for His camp is very great: for he is strong that executeth His word: for the day of the Lord is great and terrible: and who can abide it?

And then he gives the lesson:

12. Therefore also now, saith the Lord, turn ye even to Me with all your heart, and with fasting, and with weeping, and with mourning:

13. And rend your heart and not your garments, and turn unto the Lord your God: for He is gracious and merciful, slow to anger, and of great kindness, and repenteth Him of the evil.

Irresistible indeed is He who holdeth all things in His keeping, who can marshal the base things of the earth to confound the mighty, and things that are despised to bring to naught things that are. The nations well may tremble when He gathereth His great army, the locust, the caterpillar and the palmer-worm, to make the fruitful lands barren for the wickedness of them that dwell therein.

Mr. Harrington said that he was much interested in the paper which had just been read. Residents of northern temperate regions like Ontario could form little idea of the vast numbers of locusts which visited south-eastern Europe, and parts of Asia and Africa. Dr. Sharp, in a volume of the Cambridge Natural History, stated that in bulk the insects in existence in the world exceeded all other forms of animal life put together, and mentioned in illustration a swarm of locusts that was seen passing over the Red Sea in November, 1889. It was estimated to extend over two thousand square miles, and taking the weight of each individual locust at one-sixteenth of an ounce, the whole swarm was calculated to weigh the enormous amount of 42,850 millions of tons! The steamship from which it was observed, was sailing beneath the swarm at the rate of twelve miles an hour in the opposite direction and took between seven and eight hours to pass from under it.

Mr. Law spoke of the light thrown upon God's dealings with man by Mr. Fyles's paper and expressed the pleasure with which he had listened to it.

The President next called upon the Directors to report upon the insects of the year that had been worthy of note in their respective localities.

Mr. Harrington, the Director of Division No. 1, gave the following account of the season at Ottawa :

NOTES ON THE INSECTS OF THE YEAR 1897.

By W. Hague Harrington, F.R.S.C., Ottawa.

The climatic conditions obtaining during the past winter were evidently unfavorable to many insects. Intense cold during periods when there was but a scanty snowfall, alternating with decided thaws, caused extensive injury to many species of plants, and must have, in some degree, similarly affected insect life. The unfavorable winter was followed by an unusually wet spring, with frequent and violent rain storms, which undoubtedly destroyed myriads of our winged foes and friends, whose brief lives are frequently prematurely ended by heavy showers and storms. As a result, apparently, of this inclement weather there was, in the vicinity of Ottawa, a marked scarcity of the larger hymenoptera, especially of bees and wasps, the number and strength of whose colonies are dependent upon the survival of the fertilized females, and their ability to provide food for the first brood. This scarcity of macro-hymenoptera was clearly noticeable all summer ; very few of the larger ichneumonidæ, etc., being observed, except species which, like Thalessa, are parasitic upon wood-eating larvæ, and are thus not affected materially by unfavorable weather. Even in autumn, when the Spiræas and Goldenrods generally swarm with Crabro, Andrena, Halictus and many allied genera, comparatively few species and individuals were observed. The minute parasitic forms were obtainable in moderate numbers, but many species usually abundant were not met with, especially such as appear in the early summer.

As regards the occurrence of injurious insects there is but little of importance to mention. The copious rains, while destroying many insects, produced such a vigorous plant growth, that the foliage became too luxuriant to be much injured by any ordinary manifestation of insect life. The ravages of leaf feeding insects were therefore but seldom noticeable, and the foliage during the summer maintained an unusual freshness and plentitude. The only noticeable exception to the general scarcity of phytophagous insects was the appearance of great numbers of the tent caterpillars (*Clisiocampa*) Fig 19, which were more abundant and destructive than for many years. Early in spring their webs were seen disfiguring the neighboring woods, and occasionally the city shade trees, and as the larvæ increased in size, the unsightly webs became still more conspicuous among the defoliated branches. Many kinds of trees suffered from this infestation, but the most extensive operations were upon poplars, of which large areas were in some districts so defoliated as to have the appearance of having been scorched by fire passing rapidly over them. During July the newly emerged moths (Figs. 20 and 21) appeared in countless thousands, and in the city were a source of much annoyance, and some little personal discomfort. They swarmed so at night around the electric arc lights,

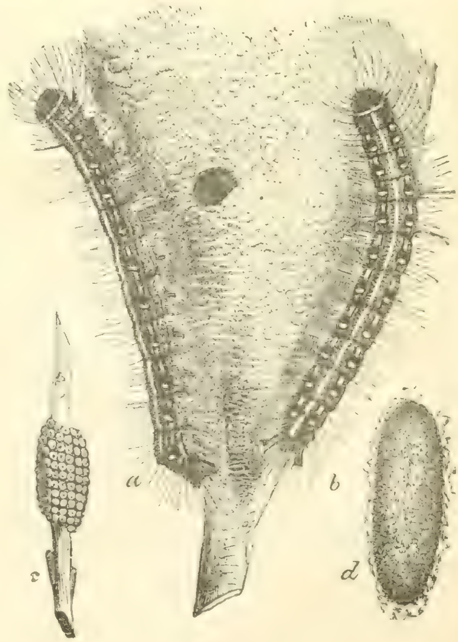

Fig. 19.

that the air seemed literary filled with them, and in their flight they dashed against pedestrians most unpleasantly. The pavements were almost covered by those which kept falling to the ground, and at every footstep a most unpleasant crunching of moths was

Fig. 20, Male Moth.

(*Clisiocampa Americana.*)

Fig. 21, Female Moth.
(*Clisiocampa Americana.*)

experienced. Upon illuminated buildings, especially upon shop windows, they fluttered and crawled in myraids, and they dashed into every open window or doorway. The plague lasted for some days, during which an immense number perished in the arc-lamps and in other ways. The tent caterpillars are among those insects but little affected by climatic changes. The clusters of eggs (Fig. 19, c.) encircling the twigs are protected by a waterproof varnish-like secretion, and the caterpillars as soon as hatched proceed to spin the web which serves to protect the colony against the weather's vicissitudes, and to some extent from various enemies. Their parasitic enemies, however, are numerous and watchful and find opportunities to infest many of the caterpillars, so that the increase of the species is checked and eventually stopped, and an unusual abundance one year may be followed the next season by a comparative scarcity.

Dr. Bethune, the Director for Division No. 2, was next called upon to report :

NOTES ON THE SEASON OF 1897.

By the Rev. C. J. S. Bethune, Port Hope.

Collectors of insects throughout the Provinces of Ontario and Quebec have, with few exceptions, pronounced the season of 1897 an "off year" as far as the capture of specimens was concerned. The scarcity of many common species may no doubt be largely attributed to the character of the preceding winter, which was remarkable for its sudden changes from mild weather to extreme cold and the frequent thaws which occurred. These great and rapid alternations of temperature are usually very fatal to any insects whose winter quarters are exposed or near the surface of the ground. But not only was the winter a trying one for insect life, the spring was for the most part cold and wet, and summer, coming very late, brought little fine or hot weather ; with the exception of some ten days of intense heat during the early part of July, the season was characterized by a series of heavy rains and frequent storms. Seldom, therefore, has there been a season when the climatic conditions were so unfavorable for the healthy development of most kinds of insects, and seldom a season when the entomologist has had so little to record.

The most serious outbreak of the year was that of various species of Aphides (Fig. 22), which appeared in countless numbers on all kinds of trees and plants, and in many cases wrought serious damage. Currant bushes seemed to suffer the most, and before the summer was over had lost all their leaves. Cherry, plum, apple and other fruit trees were injuriously affected, and in the flower garden roses, herbaceous plants and annuals were severely attacked. The cool, damp weather that prevailed during the summer was especially favorable to the multiplication of these tiny creatures, and so numerous did they become that in the month of October and on sunny days in November the air was filled with winged specimens to the great discomfort of everyone out of doors and to the especial annoyance of bicyclists, whose eyes

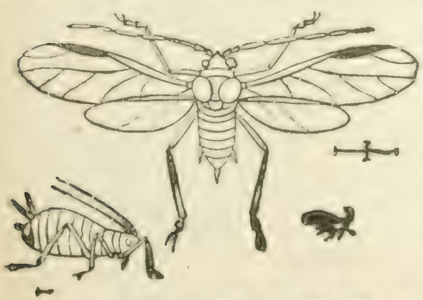

Fig 22. Winged and wingless forms of Aphis—much magnified.

became filled with them. This superabundance of aphides was widespread over large areas in Ontario, and extended to several of the neighboring States, much damage being done by them in New York, Ohio and Michigan.

In the month of May the larvæ of the Eye-spotted Bud-moth (*Tmetocera ocellana*), Fig. 23, were very abundant on plum trees in this neighborhood, and did a considerable amount of damage. This tiny insect has often been noticed in our annual reports and is no doubt familiar to most fruit growers in this Province and Quebec. It attacks the opening buds of apple, pear and cherry as well as plum trees, by eating through the leaves and forming a habitation for itself in the tender foliage, which it draws together and lines with silk. In this protecting case it continues to grow and consume the surrounding leaves, and often destroys in this way a whole cluster of blossoms or young fruit. When abundant, as it was this year, it does a very considerable amount of damage. The caterpillar is of a dull greenish-brown color, with a few short hairs on its body, proceeding from minute warts; the moth (Fig. 23) is a pretty little creature, ashen-gray in color, with a broad white band of irregular outline across the fore wings, and a black eye-like spot formed, when the wings are closed, at the outer margin of the band. From this it evidently derives its specific name. The insect can, no doubt, be kept under control by an early spraying of the trees with Paris green in the usual manner, and by plucking off and crushing the clusters of leaves containing the caterpillars.

Fig. 23. Eye-spotted Bud-moth and larva.

Last year I mentioned the reappearance of the Apple-tree tent-caterpillar (*Clisiocampa Americana*, Harris). In the latter part of May this year, I found several of the tents, or webs, on apple trees and promptly destroyed their inmates. During the month of June the moths were somewhat numerous, coming into the house at night and bouncing about the lights in their usual blundering manner. We may expect that this troublesome insect will again become abundant and cause great damage to fruit trees unless their owners are on the alert in the spring and at once destroy all egg-bracelets (Fig. 19, c) that they can find, and the nests of caterpillars in their early stages before they scatter over the trees. Wild cherry and plum trees should especially be watched, as they form a favorite breeding ground for the insect.

While the web-forming caterpillars of the spring are thus on the increase, it is very remarkable that the Fall web worm (*Hyphantria textor*) should have been scarce last year and entirely absent this year about Port Hope. Though no observations have been made, it seems evident that the destruction of this insect is due to the work of parasites, as it has been a gradual process, extending over more than one year. If the extermination had been caused by climatic influences—by the alternate freezing and thawing during the winter—it would have been a sudden destruction, the work of a single season. A similar disappearance of a common species has taken place in the case of the Tussock moth (*Orgyia leucostigma*). I did not see a single caterpillar of this species in my garden this year and observed only one moth. In Toronto, where it was so very destructive last year, it was noticeable here and there throughout the city and some trees were partially defoliated by it, but there was no widespread injury and consequently no public alarm occasioned by it. During the preceding winter the Park Commissioner, under instructions from the City Council, destroyed an enormous number of the cocoons of this insect, the sum of $1,000 having been spent in paying boys for collecting them. As all the cocoons collected were destroyed without discrimination, the wisdom of the proceeding is somewhat doubtful; myriads of useful parasites must have been put an end to as well as the pupæ of the noxious moth. It would be well in future cases of the kind to entrust the collected material to an entomologist with instructions that he should keep all parasitized cocoons till the summer following and permit the inmates to escape, and burn all the rest. Dr. Howard, United States Entomologist at Washington, has recently published a most valuable and interesting pamphlet entitled, "A Study in Insect Parasitism," in which he gives an account of a severe attack by the tussock moth on the shade trees of Washington in 1895. Very large numbers of the cocoons were collected and it was found that over ninety-eight per cent. of them were parasitized, only two per cent.

being free from the attacks of these destroyers. In 1896 the tussock worms were few in numbers, as might have been expected from such wholesale destruction, and did little injury to the trees, but this year they have increased in numbers again owing to the destruction of the parasites themselves by others which prey upon them—secondary parasites, as they are termed. Thus was verified the old rhyme:

" Big fleas have little fleas to bite 'em.
And so on ad infinitum."

The "Army worm" (*Leucania unipunctata*) which was so abundant and did so much damage throughout this Province and the neighboring States last year, was, as Mr. Moffat predicted, conspicuous by its absence this year. As far as my own observations are concerned, I did not see a single caterpillar and not more than half a dozen of the moths, nor have I heard of any injury being done by the insect in any part of the country. This immunity is undoubtedly owing to the friendly work of parasites, especially the Tachina flies mentioned in the Report for last year.

The Grape-vine Flea-beetle (*Graptodera chalybea*) [Fig. 24], has been very destructive of late years to the foliage of the Virigina Creeper (*Ampelopsis quinquefolia*). Where spraying with Paris green was not resorted to several times during the season, the vines

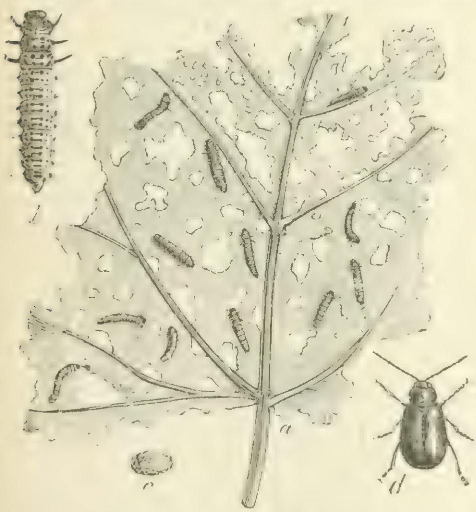
Fig. 24.

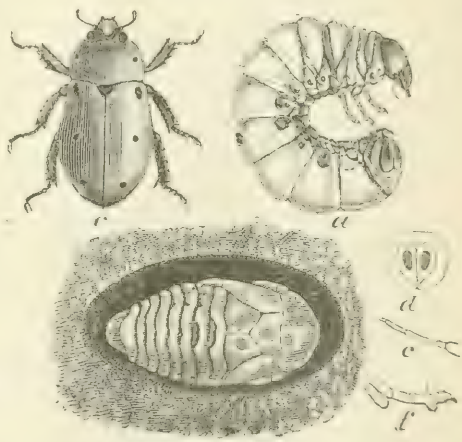
Fig. 25.

were completly stripped of their leaves before the end of August. Strange to say, a grape-vine against a fence only a few yards from some badly affected creepers was not attacked at all.

Among the interesting records of the year may be mentioned the capture of a specimen, for the first time at Port Hope, of the Spotted Pelidnota (*P. punctata*, Linn.) [Fig. 25], which feeds upon the grape-vine. I have never before met with this insect east of Toronto, but Mr. Evans tells me that he has taken it at Trenton. A specimen of *Papilio Marcellus* was again seen in the town park on the 24th of July—the same locality where it had been observed last year. Several species of *Plusia* have been common throughout the summer, visiting flowers in the day-time and attracted indoors by light at night, and have continued until late in the autumn; *P precationis* and *simplex* [Fig. 26], were the most abundant, and several of the rare *P. biloba* were captured, one as late as November 5th, when it was found sipping nectar from the few hardy flowers left in the garden.


Fig 26.

Dr. Fletcher upon being called upon by the Chairman, gave a full and interesting account of the appearance of the

San Jose Scale in Ontario, and the measures that had been taken to counteract it (See his paper on this subject, page 78). He stated that the tent caterpillars were so abundant at Ottawa, as mentioned by Mr. Harrington, that they actually starved themselves out by stripping the foliage of the trees that they infested. He did not think that they would be as numerous next year in consequence of the destruction of large numbers by parasities and the fact that many of the females were infertile and laid no eggs. The larch saw-fly had re-appeared in Eastern Ontario, but the currant saw-fly had been quite infrequent. Cut worms also were not so abundant as usual; for them the best remedy is a mixture of bran, sugar and arsenic, which should be placed, a teaspoonful in amount, at the base of the corn-hills, or at intervals between the rows where seeds have been sown in the spring. He found that the cut worms would eat this mixture just as readily when dry, as when moistened with water, and with equally effective results. The fall web-worm was not nearly so numerous as usual at Ottawa, but the aphides, as mentioned by Dr. Bethune, was excessively abundant and injurious. The leaf-hopper of the grape had been abundant in the east; it could be controlled most readily with kerosene emulsion. The horn-fly, which of late years had been such a plague to cattle, had now almost disappeared as an injurious insect, and was not so numerous as the Stomoxys, the common biting stable-fly.

The invasion of Ontario by the San Jose Scale was the next subject brought up for discussion. Dr. Fletcher spoke on the subject and read extracts from a letter he had received from Mr. Martin Burrell, of St. Catharines, and exhibited a copy of the poster which had been issued from the Central Experimental Farm at Ottawa, by direction of the Minister of Agriculture. The poster had been widely distributed to post offices, agricultural societies, etc., throughout the country and had attracted much attention. Both the Dominion and Ontario Governments were doing all they could to prevent the spread of the insect. He strongly advised that all purchases of fruit trees should be made from Canadian nurseries where the Scale had not made its appearance.

Dr. Fletcher then continued his remarks upon the insects of the year, upon which he had been speaking before the adjournment the preceding evening. The pea moth, which had been very injurious throughout the country during the last few years, he had at length succeeded in breeding, and had brought specimens for exhibition at the meeting. He had also bred the apple fruit-miner, which bores in all directions through the fruit; specimens of this fruit were exhibited. *Selandria media*, which bores into the top of rosebuds, had been successfully reared and its life history worked out. He then gave an account of the rearing of *Erebia discoidalis* and *Brefos infans*.

Mr. Harrington asked whether all trees infested with the San Jose Scale should be destroyed. Dr. Fletcher replied that a badly infested tree is not worth preserving. Experiments have been made of spraying with pure kerosene instead of the kerosene emulsion, but there was very great danger of killing the trees as well as the insects upon them.

THE WORK AGAINST THE GYPSY MOTH, 1897.

By A. H. Kirkland, Malden, Mass.

The committee having in charge the work of exterminating the Gypsy moth, in its annual report for 1896, recommended that the legislature appropriate the sum of $200,000 for the work of 1897. After several hearings before the legislative committees, in February the sum of $150,000 was appropriated. This sum being available comparatively early in the season a large force of men were set at work destroying the egg-clusters and preparing the worst infested woodlands for the summer operations. Over 1,000,000 egg-clusters, each probably containing from 300 to 500 eggs, were destroyed, 300 acres of infested forest land were cut over or thinned of trees, the ground

cleared and rubbish burned. By the time the eggs hatched the greater part of the burlaps had been placed on the trees. Spraying with arsenate of lead was commenced as soon as the leaves developed and was continued until about the middle of June. The poison mixture was applied at the rate of 20-150 gal. water, and about three tons of ingredients for making arsenate of lead were used in this work. The season proved a very unfortunate one for spraying operations. In May there were, I think, twenty days on which rain fell, and in June sixteen. In many cases this nullified the effect of the poison to a great extent and necessitated respraying. But even under these conditions from 60 per cent. to 80 per cent. of the larvæ in infested sprayed woodlands were destroyed.

Spraying with the arsenate of lead has this year shown itself as one of the best and cheapest methods for controlling the increase of the Gypsy moth. The extremely wet season favored a rank growth of foliage; this gave the insects abundance of shade, and later a great part of the large caterpillars refused to come to the burlaps, but remained clustered in tree tops. This necessitated the expensive operation of climbing a large number of trees. The season seemed also very favorable to the growth of caterpillars aside from food considerations. The abundance of tent caterpillars and canker-worms, as well as the Gypsy moth, during the past summer confirmed this view. Thorough attention to the burlaps, however, as the caterpillars matured, together with the climbing of trees and destruction of large numbers by hand, made a great inroad into the ranks of the insect. Active operations were not relaxed until all the nests had been laid, and large numbers of pupæ and few moths were destroyed by hand, thus preventing the deposition of a great many egg-clusters. In the summer work from 200 to 366 men were employed. By the time the moth ceased laying our funds ran short. 125 men were discharged and the wages of others reduced. Later, to diminish expenses still further, the entire force was laid off for two weeks. At present writing, a careful search is being made of some outlying districts, while in the inner towns a force of men is at work treating nests. As soon as the leaves have fallen the work in the outlying towns will be prosecuted, so far as means permit.

Results of the Year's Work.

The results of the year's work may be summarized briefly as follows: The increase and spread of the Gypsy moth has been well controlled, and there has been less stripping of trees throughout the whole infested region than ever before. In the outer towns marked progress has been made towards extermination. The number of outlying colonies has never been so small as at present, and the infestations of the territory included within the border of the infested region were never so well known. The number of insects taken this year in the existing outlying colonies is much smaller than that of 1896. For example, in one of the Brookline colonies about 15,000 larvæ were destroyed in 1896, where but 191 were found in the same place the past summer. While much good work has been accomplished in the outer towns, it is apparent that the moth has increased near the centre of the infested district. The results of a hasty inspection indicate that the numbers of the moth have increased in Malden and vicinity.

Considerable areas of woodland in the large Metropolitan Park system are known to be infested, but their condition, on the whole, is better than that of last year. The destruction of the eggs previously mentioned prevented the increase of the insect in the woodlands. Owing to the amount of travel through the parks this infestation will menace the surrounding region, until funds permit the prosecution of exterminative work in the parks.

What is Needed.

So far we have been unable to burn the candle at both ends. With insufficient means we cannot carry on exterminative work over the whole region. Either the outside or inside territory must be neglected to a certain extent. To restrict the border line of infestation has seemed to be a matter of vital importance to the success of the

work, and we believe that the chief efforts must be devoted to the outer towns, and in the present state of finances, controlling measures are all that can be used in the inner towns. What is needed is a good financial backing for a few years, then we shall be able to reduce the sise of our request for funds as the work ceases to be one of insect destruction and becomes more and more one of inspection.

That never since 1892 have we been able to carry out our complete plans is a continual source of discouragement. Mr. Forbush and Prof. Fernald have expended their best energies in this work. The non-salaried committee conducting the work have given freely of their time and attention. Conditions have been carefully studied and plans made, only to be hampered by lack of funds. We believe that the best possible use has been made of resources which have been placed at our disposal. If any of our friends or critics will show us how to do two dollars' worth of work for one dollar, we will then show them how to exterminate the Gypsy moth with appropriations of the size made in the past. There seems to be a growing feeling throughout the state, on the part of tax payers, that the people of this Commonwealth in protecting themselves from this insect are protecting as well the adjoining states, and, in fact the whole country. That this argument is a just one there can be no doubt, and should the insect be allowed to multiply in this region, the through traffic in freight and passengers, in a short time would probably distribute the Gypsy moth over the greater part of the country. Whether this consideration of the matter from the tax payers' standpoint will tend to reduce the size of the appropriations for our work this year is problematical. Two things are certain, we need more funds than we have yet had, and we need to just as great an extent the moral support of all who are interested in the eradication of one of the worst foes to agriculture and horticulture that has ever reached our shores from a foreign country.

ELECTION OF OFFICERS.

The meeting then proceeded to the election of officers for the ensuing year, with the following result (see page 2.)

It was moved by Dr. Fletcher and seconded by Mr. Evans, and resolved, that the library and rooms committeee be instructed and empowered to deal with matters pertaining to the library and collections, such as adding books and specimens, providing cases, &c., and to secure the proper heating, lighting and cleaning of the rooms.

The treasurer. Mr. J. A. Balkwill, read the following report of the receipts and expenditure for the year ending August 31, 1897:

REPORT OF THE TREASURER.

RECEIPTS.	
Balance on hand, September 1st. 1896..	$ 530 93
Members' fees	389 85
Pins, cork, etc	60 32
Government grant	1,000 00
Sales of "Entomologist," etc	133 37
Advertising	17 50
Interest	20 80
	$2,152 77

EXPENDITURE.	
Annual meeting and report	$ 219 08
Salaries	350 00
Insurance	28 08
Pins, cork, etc	47 00
Library	59 60
Rent	117 77
Printing	587 42
Expense acct. postage, etc	168 30
Balance on hand	575 52
	$2,152 77

We, the auditors of the Entomological Society of Ontario hereby certify that we have examined the accounts of the treasurer and find them correct, and that the above statement is in accordance therewith.

R. W. RENNIE, } Auditors.
JAS. H. BOWMAN, }

LONDON, October 8th, 1897.

The librarian and curator, Mr. J. Alston Moffat, read his annual report as follows :

REPORT OF THE LIBRARIAN AND CURATOR.

At the last annual meeting of the Society, negotiations were in progress with the directors of the Y.M.C.A. for a room in their new building ; these having been successfully completed, the property and business of the Society were moved thereto.

At a meeting of the local board it was authorized to engage assistance and have the removal accomplished with the least delay possible, as soon as the room was ready for occupation. Preparations were commenced, and with the assistance of Mr. Balkwill all the books and papers were packed into boxes of a convenient size for lifting, loaned by Secretary Saunders for the purpose, in sufficient numbers that all emptying and refilling during the transfer was avoided, proving a great convenience and saving of time. After considerable delay, final decision was arrived at to begin moving on Monday, the 16th November, and by the evening of the 19th everything was in the new room, but in terrific confusion. The transfer was made without loss or injury of any account and during most favorable weather.

The cabinets and book cases have been—according to my judgment—placed to the best advantage possible, consistent with the form and dimensions of the room, and to the procuring of the most accommodation for the work of the Society and its material on hand.

With the more conveniently situated location has come a large increase in the number of visitors, whilst much surprise and admiration has been expressed at the extent and beauty of the collections.

According to a resolution passed at the last annual meeting, the 27 volumes of the Annals of the Entomological Society of France have been bound and placed in position.

Besides those that are bound annually, a number of valuable publications that have been accumulating for the past three years were approved of by the President and bound, and thus made available to the members : also a third series of the Butterflies of America, by W. H. Edwards.

The bound volumes received from governments and public institutions during the year were the following:

The annual report of the Geological Survey of Canada for 1894.

" " " " " 1895.

" " Department of Agriculture, Ontario, for 1895.

" " Bureau of Industries, Ontario, for 1895.

The report of the N.Y. State Entomologist for 1896.

The Smithsonian report for 1894.

" " 1895.

The 48th annual report of the Regents of the New York State Museum in 3 volumes, containing amongst other important matter, a description of the edible and poisonus fungi of N.Y., illustrated by 43 colored plates.

The proceedings and transactions of the Royal Society of Canada, for 1896.

The report of the California State Board of Horticulture for 1896.

The report of the Fruit Growers' Association of Ontario for 1896.

The eighth annual report of the Missouri Botanical Garden for 1897.

The United States National Museum report for 1893.

" " " " 1894.

The seventeenth annual report of the U.S. Geological Survey, in three parts, 1895-6.

The total number of volumes added to the library during the year was 33.

The full number now on the register is 1,506.

The number of volumes issued to local members was 33.

The large number of 29 species, new to the native collection of lepidoptera added thereto by the generosity of Mr. Bice, from his captures at electric lights during the season of 1896, and those he has contributed in the season of 1897, that are already identified, with a few northwest micros received from Mr. Hanham and Dr. Fletcher, and determined by Prof. Fernald, have by that much increased the power of the Society to deal with material sent to it for identification; but much more requires to be done in the same direction, before it is in a position to meet the demands made upon its assistance from distant provinces, with credit to itself and satisfaction to those concerned.

A fine specimen of the "Tarantula," *Mygale Hentzii*, was received from Mr. B. E. Couldery, of Belleville, Ont., through the good offices of his nephew, Mr. A. C. Couldery, one of our members. A very opportune addition to the collection, when so much curiosity is excited in the community by newspaper reports of its being brought to this latitude in consignments of tropical fruits.

A further gift of Santo Domingo insects has been received from Miss Davida Ronguie, in which are some particularly interesting and attractive specimens, from that but little investigated locality.

On motion it was ordered that the thanks of the Society should be given to Mr. Bice, Mr. Hanham, Dr. Fletcher, Mr. Couldery and Miss Ronguie for their kind contributions to the Society's cabinet.

Mr. Dearness read the following report of the delegates who were appointed to attend the meeting of the British Association at Toronto:

REPORT OF THE DELEGATES TO THE TORONTO MEETING OF THE BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

Your delegates to the meeting of the British Association, held in Toronto, from the 18th to the 25th of August, have the honor to report that they duly discharged their commission.

The Association, besides its interesting public lectures and meetings in the evenings and its numerous brilliant social functions mostly held between 4 and 6 p.m., transacted its more serious work in ten different sections, working in sessions, usually from 10:30 a.m. to 3:30 or 4 p.m. These sections were respectively:

A.—Mathematical and Physical Science, which for much of its work subdivided into the departments of Mathematics. Physics and Meteorology.

B.—Chemistry.

C.—Geology.

D.—Zoology.

E.—Geography,

F.—Economic Science and Statistics.

G.—Mechanical Science.

H.—Anthropology.

I.—Physiology.

K.—Botany.

The daily number of addresses in each of these sections varied from five to fifteen, so that every day there were from sixty to a hundred addresses delivered or papers read. These were for the most part highly technical and approached the line of further advancement in the several subjects. The sections of Anthropology and Geography had by far the largest general attendance.

Subjects of a strictly Entomological character were placed on the programme of section D (Zoology) of which Professor Miall, F.R.S., was President. One of your delegates, Rev. Dr. Bethune, had the honor of being elected on its Executive Committee, where his name appears in such distinguished company as that of Dr. Anton Dorhn, Prof. C. S. Minot, Dr. L. O. Howard, Prof. C. Lloyd Morgan and Dr. Theodore Gill.

The Entomological papers read were :

1.—Mimicry as evidence of the truth of Natural Selection, (with lantern illustrations), Prof. E. B. Poulton.

2.—Economic Entomology in America, Dr. L. O. Howard.

3.—The Statistics of Bees, (an inquiry into the time occupied by the successive journeys of workers), Prof. F. G. Edgeworth.

4.—Theories of Mimicry as illustrated by African Butterflies, (with lantern illustrations), Prof. E. B. Poulton.

5.—The Army-Worm in Ontario in 1896, Prof. J. Hoyes Panton.

6.—A supposed new Insect structure, (with lantern illustrations), Prof. L. C. Miall.

Seven Canadian Committees were formed to investigate or prosecute scientific problems of special application to the northern part of this Continent. One of these was to investigate the organic life of the Pleistocene Beds of Canada ; another to secure the establishment of a Biological Station in the Gulf of St. Lawrence ; a third to study the Biology of the Great Lakes.

The Treasurer's Report showed a membership of 1,362 persons, and grants for the purposes of scientific study and research of $6,500.00. One of these is a grant of one hundred pounds sterling for an "Index generum et specierum Animalium,"

Canadian subjects naturally received much attention, but it was a pleasant surprise to hear that in the estimates of the General Committee a much larger sum of money had been voted than usual, in order to further the pursuit of investigations in Canada and to assist the above-mentioned Canadian Committees.

Respectfully submitted.

J. Dearness } Delegates
C. J. S. Bethune }

A STUDY OF THE GRYLLIDÆ (CRICKETS).

By William Lochhead, London.

The crickets are easily distinguished from the other families of the Orthoptera by their long hind legs fitted for jumping, their long antennæ, and their wing covers which are flat above and bent abruptly down at the sides. The wing covers of the males are modified for the production of musical sounds, and the females in most genera are provided with long, stout ovipositors.

Although possessing these characters in common, yet as a whole, the crickets are a heterogeneous group. For example, the mole-cricket (Gryllotalpa) is large, often one and a quarter inches long, and provided with powerful fore tibiæ fitted for digging ; while Nemobius and Anaxiphus are quite small, often less than one-quarter inch long ; the tree-cricket (Oecanthus) is delicate in structure compared with the common black crickets.

From an economic standpoint the Crickets are not nearly so injurious to vegetables as the grasshoppers and locusts, and for this very reason have not been studied as carefully as they might be. The snowy tree-cricket appears to be the only member of the family which has taken to evil habits. The eggs are deposited in the branches of certain plants such as the raspberry, blackberry, plum and peach, which are often destroyed in consequence of the boring and weakening of the fragile stem. These beautiful crickets have also been known to feed on ripe fruits.

It is possible to separate the genera of the family by the following method :

A.—Crickets with broad fore tibiæ.

B.—Antennæ long and setaceous.

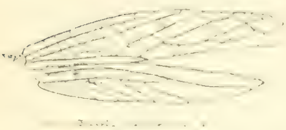

Fig. 27. Wing of Œcanthus angustipennis, female.

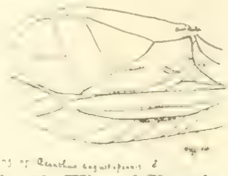

Fig. 28. Wing of Œcanthus angustipennis, male.

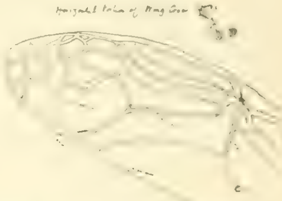

Fig. 29. Horizontal portion of wing-cover of Nemobius fasciatus, male.

C.—Fore tibiæ with four spurs, *Gryllotalpa.*

CC.—Fore tibiæ with two spurs, *Scapteriscus.*

BB.—Antennæ rather short and filiform.

C.—Body smooth ; head horizontal, *Tridactylus.*

CC.—Body velvety ; head vertical, *Rhipiptoryx.*

AA.—Crickets with slender fore tibiæ.

B.—Hind femora stout.

C.—Apical spurs on hind tibiæ five and equal, *Anaxiphus.*

CC.—Apical spurs six and unequal.

D.—Last segment of maxillary palpi nearly same length as penultimate, *Gryllus.*

DD.—Last segment of maxillary palpi twice as long as penultimate, *Nemobius.*

BB.—Hind femora rather slender, *Oecanthus.*

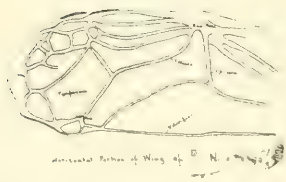

Fig. 30. Horizontal portion of wing cover of Nemobius vittatus, male.

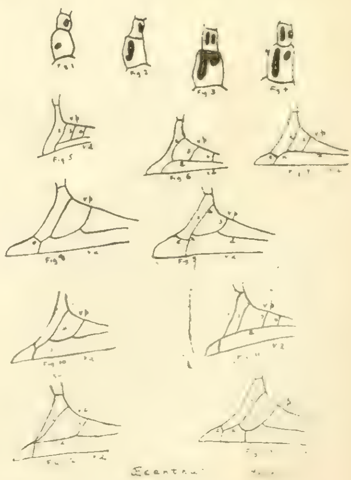

Fig. 31. Antennal marks and Harpa areas of Œcanthus.

Venation of the Wings.

H. de Saussure and J. Pungur have worked out a nomenclature of the veins in this family. That portion of the wing cover which assumes a vertical position on the side of

the body is traversed by one large vein with its branches, the *Vena Radialis*, (Figs. 27-28). This vein sends out a large number of branches towards the outer border of the wing but none towards the inner. In the case of much shortened wing covers this vein is very much stunted and often only the branches are visible. The edge formed between the vertical and horizontal portions of the wing cover is composed mainly of the *Vena Ulnaris Anterior*; the other branch *V. Ulnaris Posterior* (Fig. 27), which is easily seen in the female is hard to detect in the male. The *Vena Dividens* is a well defined vein running along the outer border of the horizontal portion of the wing cover and anastomosing with the branches of the *Vena Plicata* which traverses the horizontal field (figs. 27-30).

The Vena Plicata in the female runs directly backwards giving out four to six branches which anastomose with one another forming a net work (Fig. 27). In the male the Vena Plicata runs directly, then bends at the first quarter of its length at a right angle toward the inner border where it forms the *Anal Node*, (Figs. 28-30). The part from the bend to the Node is the stridulating instrument. From the Node the vein continues in an oblique direction again to the outer border where it unites with the V. Dividens to form a knot—*the stigma*. In this way the V. Plicata bounds a triangular harp-shaped area in which several (0 to 5) undulating cross veins run—*oblique veins*. On the outside of the oblique part of the V. Plicata there is a confusion of veins which partly come from the Anal Node and partly from the V. Plicata so that in the last third of the wing there is a roundish area, the *Tympanum* or *Mirror* sometimes crossed by one or two cross veins. Behind the mirror lies a network of veins.

GRYLLUS.

Scudder in his materials for a Monograph of the N. A. Orthoptera enumerates six species, namely: *lucluosus*, *abbreviatus*, *angustus*, *neglectus*, *niger and Pennsylvanicus*. Following Scudder's descriptive remarks I have compiled the following synoptic table:

Species.	Color of Elytra.	Length of Elytra.	Length of Ovipositor.	Hind Femora.
			in.	in.
1. Luctuosus	black or brownish	....	.70	.45
2. Abbreviatus	dark, bordered with light brown.	covering abdomen	.74	.44
3. Angustus..	like No. 2 but mo	re slender	.64	.38
4. Neglectus	black or jet black.......	as long as abdomen	.56	.40
5. Niger	....	longer than neglectus ...	.45	.44
6. Pennsylvanicus	like neg	lectus	.45	....

It will be apparent that the distinctions are based chiefly on the length of the ovipositor of the female which I found to be extremely variable. Moreover no method of identifying the males has been given. As far as the color is concerned it is of no value as a guide to species since it, too, is very variable. Saussure admits (Melanges Orthop. p. 317) that the species seem to grade into each other, and "it is impossible to define the limits of each. The accidental shortening of the wings already sufficiently embarrassing in itself seems often to become complicated with a shortening of the ovipositor. The color is very variable and it is impossible to settle on any character with certainty which can separate the species." The length of the ovipositor is made the chief character in distinguishing the two species of Saussure and Beutenmüller. I find in my collection all lengths from 10 to 21 mm., so here it is impossible to draw a limit.

Saussure gives the names *abbreviatus* and *luctuosus*. Under the former he places the varieties *neglectus* and *Scudderianus*, and under the latter he places the variety *Pennsyl*

vanicus. Beutenmüller gives the names *abbreviatus* and *Pennsylvanicus*. Under the former he places the variety *augustus* and under the latter he places the varieties *luctuosus*, *niger* and *neglectus*.

An effort was made to separate the species of Gryllus by the aid of the wing venation but it was impossible to find variations which were constant. The number of oblique veins varies from three to five. The diagonal vein or vena plicata bifurcates to form the mirror which is more or less rounded. A transverse vein crosses the mirror. In all specimens examined the structure of the mirror remains practically the same; the transverse vein in some cases is rather faint. Beutenmüller states that *abbreviatus* has a much larger head and is more clumsy than *Pennsylvanicus*, but I fail to see any differences. One form *luctuosus* has long hind wings which project like tails behind the wing covers. This character is peculiar to both sexes. I see no reason why this character is not sufficient to delimit this form as a distinct species. We may then refer all the other varieties of the region to one species *abbreviatus*.

Fernald describes *abbreviatus* as follows: Black, elytra fusco-testaceous; veins testaceous; wings wanting; ovipositor as long as body.

The same author describes *luctuosus*: Black or brownish; elytra fusco-testaceous or black; wings extending to the end of the abdomen; ovipositor as long as the femur and half the tibia.

Nemobius.

From the study of the tympanal areas of wing covers of the males of Nemobius I am unable to find any constant variation in the venation, so I am obliged to place all the members under one or two species by reference to plates. It will be seen that the harp area is traversed by only one oblique vein, that the tympanum is sometimes quadrate, sometimes more irregular, often with veins penetrating it and ending blindly. The degree of development of the apical part of the wing cover varies even in the same variety. The extremity of the wing cover is not prolonged but widely rounded, and the tympanum is thrown far back so that the apical area is very short and is composed usually of but one row of cells. The vena plicata bifurcates to enclose the tympanal area which moreover encloses two, sometimes three cells. (Figs. 29-30.) Saussure is unable to separate our forms by any constant variation in the tympanum and my studies confirm his conclusion.

As in Gryllus there is a form with long caudate wings. I would be in favor of limiting the species *fasciatus* to this form. The remaining forms would then fall into the species *vittatus*—the smaller forms making the variety *exiguus*.

Œcanthus.

The specimens of Œcanthus collected about Ithaca, N.Y. and Windsor, Ontario, present many variations in venation, color, shape of wing and surface markings. They were collected during August, September and October, and the great majority of them were caught on Ambrosia artemisiæfolia (ragweed) and Euphorbia corollata (white spurge). A few were taken on grape vines, orchard trees and sumach. In color the specimens ranged from snowy white to almost black.

I have made an attempt to classify the species of Œcanthus according to the venation of a portion of the wing cover of the male. This is the portion called the *harpa* by Brunner. As will be seen by reference to a drawing of the wing cover of a male the vena plicata during the first quarter of its course forms the file or rasp. Extending in an oblique direction from the file are two or more veins more or less undulating which connect with the vena dividens. The file and oblique veins constitute the harp. Evidently the function of the oblique veins is to make tense the large vein to which they are attached.

The chirp of Œcanthus is a sexual call of the male to the female. It is natural to suppose that the females recognize the peculiar call of the males of the same species and

cannot be lured by the calls of a different species. If such be the case then the peculiar sounds and calls must be produced by harps differing a little in structure, perhaps in the number of oblique veins or in the tenseness of these veins, that is whether undulating or straight.

The classification of the species is somewhat difficult. Several entomologists prefer to place all our native members in one species while some would make three or four. This question will remain in dispute till the life history of the genus has been thoroughly worked out and experiments have been made upon interbreeding.

Charles A. Hart of Champaign, Illinois, in an article in the Entomological News Vol. 3, 1892, page 33 divides the Œcanthi by means of black markings on the first two segments of the antennæ. These markings are very distinct and appear to be quite constant, and should they be discovered to be of functional importance are of great value as they are discernible by the naked eye, and easily outlined with the aid of an ordinary lens. In *Niveus* (Fig. 31, 1,) the markings are two black circular spots, one on underside of first and second segments.

In *Angustipennis*, (Fig. 31, 2,) the markings are a curved black line on first segment and a black oval spot on second.

In *Nigricornis*, (Fig. 31, 3 and 4) on the first segment there are a black longitudinal line, and a black spot exterior to it with similar markings on second segment. In some cases the markings are confluent at the upper part of the first segment.

Figure 31, 5 shows the venation peculiar to the harp of Niveus. The number of oblique veins varies from three to five, only the first two meeting the vena dividens. These undulate considerably and meet vena dividens at an acute angle. Oblique veins three, four and five extend parallel to one and two, but end in a second longitudinal vein (*d.*)

The venation of Angustipennis, (Fig. 31, 6) is remarkably like that of Niveus but there is a difference in oblique vein two. In Niveus it seems to extend from the vena plicata to vena dividens, but in Angustipennis it ends at the longitudinal vein (*d*) which is continued down to vena dividens.

The venation of *Nigricornis* (Walker) is decidedly variable, yet a study of the variations as in figure 31, 7-13 reveals a type which embraces all the forms. By far the largest number have the venation as shown in figure. By a reference to figure 31, 7-13 it will be seen that an additional cross vein has been developed between the oblique veins one and two, and which is marked (*e*) on figures. The migration of veins has been somewhat remarkable ; in some cases a straightening has taken place so as to make one vein out of two as in figure 31, 11, where cross vein (*e*) and (*x*) portion of oblique vein two have been united into one line. In some cases (*e*) and (*x*) have become more inclined to each other as in figure 31, 10, while in other cases the oblique veins (1) and (2) have converged and united with the disappearance of veins (*e*) and (*x*) as in figure 31, 12. In figure 31, 8, (*e*) and (*x*) have begun to straighten ; in figure 31, 9 oblique vein two has straightened itself. Usually there are only three oblique veins but occasionally a fourth is found as in figure 31, 5, 6 and 11.

Keys for the Determination of the Species of Œcanthus.

I. Males.

A. Wing covers with a cross vein between the oblique veins 1 and 2 of harpa —*nigricornis*.

AA. Wing covers without a cross vein between the oblique veins 1 and 2 of harpa.

B. Second oblique vein extending to vena dividens—*niveus*.

BB. Second oblique vein terminating at longitudinal vein between V.V. plicata and dividens—*angustipennis*.

II. Females.

A. Wings extending beyond the tip of ovipositor.

B. Pronotum with a single mesal brown band—*angustipennis.*

BB. Pronotum without a mesal brown band—*niveus.*

BBB. Pronotum dark or with three bands—*nigricornis.*

AA. Wings not extending beyond the tip of ovipositor—*nigricornis.*

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Scudder, S. H : A Century of Orthoptera. Proc. Bost. Soc. Nat. Hist., Vol. XII, 1868, pp. 139-143.

Stal, C. : Recensio Orthopterorum. Revue Critique des Orthoptères décrits par Linné, De Geer et Thumberg. Stockholm, 1873-5.

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A paper on *Drasteria erechtea* by Prof. F. M. Webster, illustrated with some very beautiful drawings, was read by Dr. Bethune.

A vote of thanks to the Treasurer and Secretary for their labours in the interests of the Society, was moved by Dr. Fletcher, seconded by Mr. Fyles, and carried unanimously.

Mr. Harrington, seconded by Mr. W. E. Saunders, moved a vote of thanks to Mr. Dearness the retiring President, for the interest he had taken in the affairs of the Society and his labour on its behalf. Carried unanimously.

During the meetings many rare and interesting specimens were exhibited by those present, among which may be mentioned a large number of moths obtained at electric lights by Mr. Bice of London, and the following, collected in the neighborhood of Quebec

by Mr. Fyles and other members of the Quebec branch: *Phyciodes nycteis*, *Terias lisa*, *Sannina exitiosa*, *Spilosoma congrua and cunea*, *Rheumaptera basiliata*, *Tetraphora testata*, and *Conops sagittarius*. Mr. Fyles also reported the capture of *Anarta melaleuca* and *Melipotis limbolaris*.

The meeting then adjourned, after a very profitable two day's session, during which much enjoyable time was spent in the comparison of specimens, and in examining the many interesting books and cabinets belonging to the Society. All who were present expressed their pleasure at the new quarters of the Society, which are so much more convenient, as well as brighter and more comfortable than the former rooms.

THE VALUE OF SYSTEMATIC ENTOMOLOGICAL OBSERVATIONS.

By J. Alston Moffat, London, Ont.

Francis Albert Rollo Russell, Esq., Vice-President of the Royal Meteorological Society, &c., &c., has this to say upon the influence of weather on insect pests:

"The effect of a particular kind of season on insect pests is worthy of more attention than it has hitherto received. The importance of attacking in time and as far as possible destroying the insect life which, if neglected, inflicts incalculable damage on crops and gardens, has scarcely been realized, owing to the blight being generally regarded as a necessary evil, not to be foreseen or prevented. The development of insect pests is generally favored by dry weather. Stunting of the growth, and over maturation of the sap of plants induce early changes in the maturing and structure of aphides; the insects multiply without the interference of the ordinary destructive influences of bad weather, and delicate maggots, etc., which are generally drowned in very large numbers by storms of rain, emerge unharmed. At the same time it may happen that corn and other crops may be enabled by earlier hardening of the case, stalks, etc., to protect themselves against attacks which in wet years would bring serious damage. In some countries, and in respect to some crops, it is customary to arrange the date of maturity with special regard to the protective power of the plant and the period of expected attacks from insects. The whole subject is at present too little under scientific observation, and great benefit might result if the following branches of inquiry were systematically investigated: (1) The influence of different kinds of weather in developing insect pests; (2) the time of appearance of crop insects in different seasons in relation to the weather, and the time at which crops are most open to attack in different seasons, according to the weather; (3) the treatment of the ground in drought with a view to destroy threatening pests in their early stages, and, in general, the conduct of agricultural operations with regard to the probable development of particular pests resulting from particular kinds of weather; (4) the issue of forecasts of insect prevalence, derived from a careful study of the habits of various species of insect pests, and of the weather of present and previous seasons."

Everyone knows and admits the powerful and direct connection that exists between the weather and the crops.

That the weather has a powerful influence on the propagation, maturation, multiplication, migration and consequent spread of insect pests, is known only to those who have given the matter some consideration. That some insects are in the habit of appearing periodically is a truth well established by observation, and that the weather must affect these appearances can readily be inferred.

The weather of an extensive territory is often quite diverse in the different portions of that territory, and we can form but very little idea of the influences that are at work, or where they may be at work, in producing the particular kind of weather existing at any given time, in any given locality.

Lieut. Maury, U.S.N., in his magnificent work "The Physical Geography of the Sea," gives his reasons for believing that the great bulk of the precipitation on this continent is evaporated from the sea of the southern hemisphere. The meteorological

observations inform us at times that a violent storm in the Gulf of Mexico is making itself felt in the Gulf of St. Lawrence. Such statements as these assist us in forming some estimate of the far reaching influences that may be affecting the weather of our particular locality.

The forecasts of the weather for the succeeding twenty-four hours, which we have become accustomed to regularly consult, and in good measure to rely upon, and which have proved to be of such immense value to multitudes in their everyday movements upon land or water, are not a matter of guesswork as some seem to suppose, but the condensed result of a vast amount of information gathered together into one central office from numerous distant stations, where it is examined and systematically arranged on purely scientific principles, before the probabilities are issued for the benefit of those living in the different regions into which the country has been divided.

The governments of various countries, realizing the advantage that would accrue to their people from a foreknowledge of what the weather would be for even one day, have established, at very considerable expense, stations all over their countries with suitable instruments for registering the atmospheric conditions and changes, with a competent person in charge to note these and transmit them by telegraph to the central office at stated times. The qualified meteorologist in charge of the central office or weather bureau receives these dispatches from all the separate stations far and near, and has to arrange, compare and condense the information thus obtained. Having been thus placed as it were upon an elevation from which he can survey the whole atmospheric movements that are going on all over the country at one glance, and being familiar with the laws that govern these movements, he has to make his observations from what they are at the present, as to what they are likely to be during the next twenty-four hours in the different regions into which the country has been divided.

For instance, he receives from a station hundreds of miles away information that a storm of a particular kind is raging there, the wind blowing in a particular direction, at the rate of so many miles an hour, he has to calculate by the rate it is travelling and its direction, at what particular time it will be likely to reach particular points along its course. But he may get at the same time information that hundreds of miles away in the opposite direction another storm is prevailing, which may throw the previous calculations completely out as he has now to take into consideration what influence the one will have upon the other, and if they unite what is the direction it will pursue, and whether with increased or diminished force. And so it is through the whole range of every condition and commotion of the atmosphere that exists at any particular place all over the country. Such a brief statement may help to show how thoroughly the weather bureau is under intelligent and scientific control, and that we may confidently rely upon its forecasts as proximately correct. And if the informing stations were increased in numbers, and the regions for which the probabilities are issued were reduced in dimensions they would be yet more reliable.

Now North America is getting to be pretty well dotted over with agricultural experiment stations, supported by government aid, for the benefit of the agriculturist and the general good of the country, and every well appointed agricultural station has an entomologist attached, whose duty is to report upon the depredations done by insects in his particular district, and the means taken to prevent or lessen the same, and bulletins are issued with more or less frequency giving the results of the work done by each, and the success obtained, partial or complete, or none as the case may be, and the probable reason for the same indicated.

Everyone who has the opportunity of seeing the quantity of literature of this description that is being issued from the various stations must be impressed with the industry exhibited in the investigations that are being made into the life and habits of insect pests, and the best means to be used in preventing their ravages. Now as each of these entomologists is in great measure working independently of all the others, and may not be informed as to the department that others are engaged in investigating until it appears in the bulletins of their respective stations, there cannot help but be a good deal of

duplicating of each other's work going on, and as the seasons are short for some departments of this kind of work, and as attention must be given to it while the opportunity lasts, if the work is to be accomplished at all, many of them may not find the time for reading all that is necessary to keep them informed of what others are doing in a similar line. This fact has recently been fully stated by one who is himself well to the front in this kind of work, when he remarked that with the regular daily work of his position to attend to, it was utterly impossible for him to read all the bulletins that came to his office, and he requested as a favor, that any having matters of special importance that they wished him to see, should mark their papers so that he might not run the risk of losing the benefit of it. This statement discloses both the weakness and the needs of the entomological work that is being done in connection with the agricultural experiment stations.

The highest results in any work can only be reached by united effort under the supervision of one directing head.

With the apparatus and methods of the weather bureau before us, it seems easy to indicate a remedy for the present waste of time and energy that results from each individual entomologist pursuing his vocation with reference almost exclusively to his own locality, and with little information as to what others may be doing at the same time.

It would appear then as if the pressing need of the present system to complete its efficiency is a central bureau of entomological intelligence, with a person in charge appointed solely for his suitability for the position, and whose whole time could be given to the work of supervision. With such a permanent, central office established for giving and receiving information upon all manner of entomological subjects, we can easily understand how it would tend to unite the widely separated entomologists on the staff of the different agricultural stations, making them realize that they were not working alone though separate, and that each being kept informed of what the others were doing would in a measure reap advantages from the other's labors. And when one considers how much has already been done, largely by individual labors, we can form some estimate of how much more might be accomplished by well directed united effort under intelligent guidance. And as the regularly appointed entomologists increase in numbers, the greater will become the need for such a central systematizing bureau to prevent a waste of energy in duplicating each other's work, and that these will increase rather than diminish is certain, as the value of their labors is only now beginning to be realized, and the expense of their maintenance is being returned to the community a hundred fold.

It would be an easy matter to indicate how such a bureau should be conducted, but its ordinary work would be largely controlled by circumstances and necessities, as the course of events required. But it would be known to exist for the express purpose of receiving and disseminating all sorts of information about the doings of insects all over the country, and the best means of combating or preventing their depredations. Thus, the person in charge being kept fully informed of what was going on in the insect world, far and near, might be able to give warning of danger to one locality from what he had been informed was going on in another: and in the case of migratory insects, only such a fully informed person could indicate effective means of dealing with them, and in such a case, the meteorological and climatic conditions are of the first importance. He might even be able to issue forecasts of the probabilities for the coming season. We know what correct guesses Mr. Scudder made about the spread of the imported cabbage butterfly, from scant information gathered with great labor. I took my first Colorado potato beetle at Hamilton, about three years in advance of the time calculated for its appearance in that locality, indicating that the calculations had been made upon insufficient data.

Then there would be bulletins issued from this central bureau, with more or less frequency, as the circumstances required, which every entomologist would be sure to read, as they would be expected to contain a summary of the latest intelligence of what was being transacted by, for or against the insect community all over the continent, or the world for that matter, which could not fail to prove of the utmost interest and advantage to every student in that line, whether he is economic, scientific, or recreative, and would

keep each informed of what others were doing, and save in many instances an unnecessary expenditure of time and labor.

The information received at such a bureau need not be confined to that coming from the regularly appointed entomologists at the agricultural stations, but from every person who took an interest in the subject, and who had made an observation which he thought was worthy of reporting. Thus the sources of information would be increased, which are at present quite too few and widely separated. But we hope for a time when every town and district will have at least one intelligent observer to report for that locality. Then, how many curious, interesting and important questions of insect economy that long have, and still remain involved in mystery, will find a solution through the united systematic work of numerous observers? Thus, with those interested in the doings of insects at shorter distances apart, the east would be united to the far distant west, and the north with the south by means of this central bureau, and instead of our having bits of information about widely separated spots, as if they stood apart and alone, we would get an intelligent connected view of the various steps in the progress which unite the two extremes into one harmonious whole.

ON BUTTERFLY BOOKS.*

By Henry H. Lyman.

Having been asked by one of the members of our branch for advice on the books most necessary for one engaged in the study of the North American Lepidoptera, I have thought that this subject might be of sufficient interest to some of our other members as to render it not unsuitable for a short paper.

Hitherto I have always recommended anyone entering upon the study of North American insects to purchase Harris's Insects Injurious to Vegetation as the first and most necessary work upon the subject, and I recently noticed in a paper by Dr. S. H. Scudder, on "The Young Entomologist and what he wants," reproduced by the Montreal Witness, from the "Independent," that the writer gives the same advice saying, "the best single book is Harris's Insects Injurious to Vegetation."

If Harris's classic work no longer enjoys that unquestioned supremacy which it has held for so many years, the only work which may claim to rival it is Prof. Comstock's "Manual for the Study of Insects," which has certainly some very valuable features, and is of course more modern and "up to date," though one may not agree with all the views set forth. I should certainly recommend both these works to everyone entering upon the study of entomology.

A smaller and much cheaper, but very useful work is Dr. Packard's "Entomology for Beginners." It serves as a general introduction to the science, treating of the "Structure of Insects," "Growth and Metamorphosis of Insects," "Classification," "Insect Architecture," "Injurious and Beneficial Insects," "Directions for Collecting, Preserving and Rearing Insects," with directions for dissecting insects, cutting and mounting microscopic sections of insects, and a list of the most important works on general entomology and the biology of insects, together with a glossary and index. Naturally with so much ground to be covered but little space could be given to the consideration of the different orders, thus only 24 pages are given to a review of the coleoptera, 20 to the diptera, 24 to the lepidoptera, 16 to the hymenoptera and 36 to the other orders.

To any one wanting a more extended guide for the collecting, rearing and preservation of insects, no better work can be recommended than Dr. Knagg's "Lepidopterist's Guide," which is issued at the moderate price of one shilling, and which though, of course, written for English collectors, will be found very useful by all, as its general directions and suggestions as to treatment are very generally applicable.

* Read before the Montreal Branch of the Entomological Society of Ontario, 8th December, 1896.

When we turn from general works to those dealing with a single order, either in whole or part, the choice is more difficult and no one book is sufficient.

To any one who has the money to spend and who is interested in the butterflies of the whole continent north of Mexico, no finer work can be recommended than the magnificent volumes of Mr. Wm. H. Edwards on the butterflies of North America with their 152 exquisite coloured plates, but unfortunately the price, aggregating $135 for the three volumes, places the work beyond the reach of the great majority of lepidopterists.

For the butterflies of the Eastern United States and the contiguous parts of Canada, Scudder's splendid work leaves nothing to be desired, as it is a complete manual on the most elaborate scale of the butterflies to be found in the region, with a great wealth of illustration, but unfortunately its price, $75, puts it also out of the reach of very many.

An excellent work, dealing with almost the same territory but comprising about one-fourth more species and published in 1886, at a moderate price, is French's "Butterflies of the Eastern United States." This is a very useful work of 402 pages and gives descriptions of 201 species. The nomenclature and classification follow those of Mr. W. H. Edwards. Short directions are given for collecting, setting, preserving and rearing specimens, and there is an acccentuated list and an analytical key. The preparatory stages where known are described with considerable detail, and the distribution is given in a general way. There is, however, a dearth of illustrations, especially in the Lycænidæ and Hesperidæ.

A less pretentious but extremely useful work is Scudder's "Brief Guide to the Commoner Butterflies of the Northern United States and Canada," published in 1893, by Henry Holt & Co, at the very moderate price of $1.25. The author has selected for treatment 84 species which he judges would be almost surely met with by an industrious collector in the course of a year or two years' work in the Northern States east of the great plains and in Canada, but such as he classes as "rare" or occurring only in restricted localities are omitted. This, I think, is a pity, as no one starts out to collect merely common things however beautiful, and we all long for the rare and valuable. Besides, several are omitted which occur over wide areas, such as Grapta Gracilis, which is found in the Adirondacks, the White Mountains, in the Muskoka region, on the Lower St. Lawrence and even to the extreme end of the Gaspe Peninsula, and also Colias Interior, embracing a similar but apparently still wider distribution.

One great charm that I found in the acquisition of my first entomological work, viz, Coleman's British Butterflies, was that it treated of *all* the species found in Great Britain, and so I felt confident that whatever I caught I would find treated of there, and it certainly seems to me that the few extra pages that would have been required for these species, even if their addition had slightly enhanced the cost of the book, would have been well worth the cost.

This book has no illustrations of any of the species, but though this is doubtless disappointing to the beginner, it has this advantage that when he has worked out the determination of any butterfly by the analytical key and the description he has a much more scientific knowledge of the species than if he merely named it by a superficial comparison with a good figure. The nomenclature, of course, is Mr. Scudder's own, the general adoption of which most of us, I think, would regard with disfavour. Otherwise the book has much to recommend it to the beginner.

Another work, of very limited scope but very beautifully illustrated, is Beutenmüller's "Descriptive Catalogue of the Butterflies found within fifty miles of New York City," published in the "Bulletin of the American Museum of Natural History," separate copies of which may still be obtained from the author at $1 each.

This work consists of sixty-eight pages and five plates, two by the Lithotype Printing Co. being especially fine. Ninety-three species are treated of and of these sixty-two are figured. Descriptions of the caterpillar and chrysalis are given where known, and the food plants and short notes on the life history. It is certainly to be regretted that this pamphlet is not more generally accessible.

"The Butterflies of Maine," published by Prof. C. H. Fernald in 1884, is an excellent pamphlet of 104 pages, describing the sixty-nine butterflies known to have been taken in Maine. It contains an accentuated list of the scientific names and the principal "common" names which have been given, and there is also an artificial key for the determination of the butterflies. There are no plates but there are thirty-five wood-cuts illustrating a number of the species in one or more stages.

For the Sphingidæ, the most important work is Prof. J. B. Smith's Monograph, published in Trans. Amer. Ent. Soc. XV., 1888, and obtainable separately at $2. This work extends to nearly 200 pages and is very exhaustive in its treatment. There are ten plates, eight devoted chiefly to the genital armature and two chiefly to venation, but there are no figures of species. About 30 pages are devoted to tracing the classification of the group from the time of Linnæus in 1758 down to the publication of this monograph in 1888. The preparatory stages are not described, but where known may be found from the references, which are very complete. This, however, has the disadvantage of compelling the hunting up of these descriptions in other works, which one may be unable to do if a complete entomological library is not within reach.

"The Sphingidæ of New England," published in 1886 by Prof. Fernald, is an excellent pamphlet of eighty-five pages and six plates, illustrating ten species, with the larva or larva and pupa of most of them. Forty-two species are described, and there is an analytical key and the scientific names are all accentuated and the work is on similar lines to the same author's "Butterflies of Maine."

"Descriptive Catalogue of the Sphingidæ found within fifty miles of New York," by Wm. Beutenmüller, is another excellent work on the same plan as his work on the butterflies. It consists of forty-six pages and six plates, which figure forty-two species, while forty-six altogether are described in the text. With such a work no one should have any difficulty in determining his specimens. This work was published in the Bulletin of the American Museum of Natural History, and except for the few author's separates is unfortunately only accessible to those able to consult this work.

For the groups intervening between the Sphingidæ and the Geometridæ there is as yet unfortunately no approximately complete work, nor indeed any work other than check list or catalogue at a moderate price.

In July, 1872, Mr. R. H. Stretch undertook the publication of a work entitled "Illustrations of the Zygænidæ and Bombycidæ of North America." It was to be issued in parts, each of which was to contain a coloured plate. The work was intended to extend to thirty parts at $1 each, or with plain plates 75c. each. The genera and species were not taken up in consecutive order but irregularly as specimens could be obtained, and as the work was discontinued after the issue of the ninth part, with which the author closed his first volume, it is very incomplete, and while rather costly in the first instance has become more so from its comparative rarity.

Dr. Packard has begun the publication of a sumptuous work, "A Monograph of the Bombycine Moths of America, north of Mexico." The first volume, which is all which has so far appeared, treats of the Notodontidæ, and costs $15 in paper covers, or $16 bound in cloth, and is, therefore, a costly work. The part already issued is a quarto volume of 291 pages with forty-nine plates, ten maps and eighty-five cuts. Of the plates seven are of the moths, one being coloured and the others done by the heliotype process, thirty which are coloured illustrate the larvæ with great fulness of detail, ten are devoted to venation, one to other structural details, and one to three moths with the larvæ of two of them.

The eggs and cocoons or pupæ are not illustrated on the plates, but a number of pupæ are illustrated in the introductory part of the work.

For the Geometridæ the monumental "Monograph" of Dr. Packard, published by the United States Government as one of the volumes of its geological survey of the territories, should be in the hands of every lepidopterist who can afford the very moderate price, $4 I believe, at which it is, I suppose, still obtainable.

This magnificent work is in quarto form, consists of 607 pages and 13 beautifully engraved plates, six being devoted to venation, one to anatomical details, and the remaining six to the perfect insects and a few larvæ and pupæ. These six plates contain no less than 389 figures of moths, and thirty-six figures of larvæ and pupæ. The work embraced all species of this group known to Dr. Packard up to the date of its publication, and is indeed wonderfully complete.

For the Pyralidæ I know of no exhaustive work, but for the Phycitidæ the paper by the Rev. Geo. D. Hulst in the Trans. Am. Ent. Soc. XVII., 1890, and obtainable separately, I believe, for about one dollar, should be studied. This paper consists of 136 pages and three plates illustrative of structure and venation.

For the Crambidæ, Prof. Fernald's recent monograph of eighty pages, with its three plates of venation and structural details, and its six exquisite colored plates of the species is all that could be desired, but for the Tortricidæ there is no reasonably complete work at a moderate price One of the earliest illustrated papers was that by the late Coleman T. Robinson, published in Trans. Am. Ent. Soc. II., 1869, which was intended to be the first of a series to include the whole of the species found in the U. S. This first paper illustrated with six beautifully colored plates, embraced descriptions of no less than seventy species, but the project was cut short by the untimely death of Mr. Robinson. Since that event the chief work issued on that group is that of Lord Walsingham, eighty-four pages, quarto, with seventeen colored plates, published by the trustees of the British Museum, but this is a somewhat expensive work, costing £2.

I do not know of any general work on the Tineina.

In regard to catalogues and check lists, there is no general catalogue of North American Lepidoptera. For a mere check list I would recommend that issued by Prof. J. B. Smith, with the assistance of Drs. Skinner, Hulst, Fernald and Riley, which is sold at $1.00.

For the butterflies Edwards's " Revised Catalogue of Diurnal Lepidoptera," issued in 1884 is to be recommended, though Dr. Strecker's catalogue, issued in 1878 at the cost of $2.00, though having certain defects, contains much useful information and more complete references.

For the Sphingidæ, Zygænidæ and Bombycidæ, using the latter term in its older sense, there is no American catalogue, but they are, of course, embraced in Kirby's world-wide catalogue of Sphinges and Bombyces, with the exception of some of the groups, such as the Ægeriadæ, which he excludes, but this is an expensive work costing £2 4s

For the Noctuidæ we are indebted to Prof. J. B. Smith for a comprehensive catalogue of 424 pages, which is obtainable for $2.50.

Other works might be mentioned with commendation but the selection has been purposely restricted to those which are most indispensable.

Of books on the other orders of insects I am not competent to speak, but for any-one who is primarily interested in the economic relations of butterflies or other insects no works can be more highly recommended than " Insects Injurious to Fruits," by Dr. Wm. Saunders, and Prof. J. B. Smith's " Economic Entomology."

It is, doubtless, impossible to do much in the entomological line without some books, but by a judicious selection ten or twenty dollars may be laid out to purchase a very fair selection of the most useful works for a beginner, and then other works could be added as one's interest in the subject developed and one's means would admit.

SOME HOUSEHOLD INSECTS.

By Rev. C. J. S. Bethune, Port Hope.

So many enquiries are repeatedly made respecting common insects that frequent houses and cause annoyance to the inmates, or damage to household goods and provisions,

that it has seemed desirable to give some account of those most frequently complained of, and suggest some methods of dealing with them. Hitherto very little has been published upon this class of troublesome insects, and not much has been known about their life histories; but last year the deficiency was satisfactorily removed by the publication at Washington of a bulletin on "The Principal Household Insects of the United States," by Dr. Howard, Entomologist in Chief of the Department of Agriculture, and his assistants, Messrs. Marlatt and Chittenden. In the following pages we shall freely draw upon this work, as nowhere else can the same accurate information be obtained, and by no other writers have the life histories of these insects been so carefully studied and the details so clearly and admirably set forth.

Cockroaches.

Most houses in towns and cities are infested with cockroaches to a greater or less extent, and even isolated dwellings in the country are sometimes inhabited by an unwelcome colony of these creatures. I have known them to be introduced into remote places by means of the trunks of visitors, or packages of groceries received from some distant city. Mr. Fyles (15th Annual Report, 1884, p. 43) relates the occurrence of large numbers at Chaudiere Curve, a wayside station, nine miles from Point Levi, P Q, where luggage is transferred from the Grand Trunk to the Intercolonial Railway, and *vice versa*, and where the insects were evidently brought by immigrants from Europe. They usually frequent kitchens and pantries and are especially abundant about the stove or fireplace on account of their fondness for heat. For this reason, as well as for the sake of the abundant food supply, they are often present in great numbers and become a perfect nuisance in bakeries. They are also excessively numerous and troublesome on board ship, the moisture and heat of the vessels being particularly favorable to them. In the daytime they are rarely seen, as they always avoid the light, and conceal themselves in crevices, behind baseboards, under boxes or barrels, etc, wherever in fact they can squeeze their flat, thin bodies, and escape observation. If disturbed they scuttle off with great rapidity to the nearest hiding-place and can rarely be captured or destroyed. It

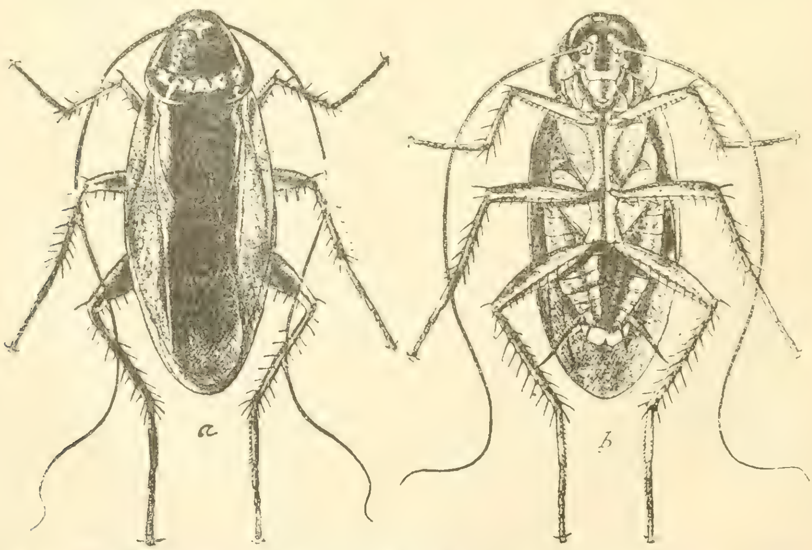

Fig. 32. The American Cockroach; *a* view from above; *b* from beneath; both enlarged one-third (after Marlatt).

sometimes happens that a large colony has established itself in a kitchen for months without being discovered, till a sudden entry with a light after the usual hours has revealed their presence.

Cockroaches belong to the family Blattidæ, of the order Orthoptera, which includes crickets, grasshoppers, locusts, etc. This family consists of a very large number of species, nearly a thousand having been named and preserved in collections, and it is estimated that about four times as many more are in existence in the world, chiefly in tropical countries. The great majority of them live out of doors and are vegetable feeders, and some attain to large dimensions. I have a specimen from Mexico, whose wings expand five inches, and larger species than this are known. Happily, but few species have become domesticated, and in North America there are only four that can be regarded as household pests. These are the American Cockroach (*Periplaneta Americana*), the German (*Ectobia Germanica*), the Oriental (*P. orientalis*), and the Australian (*P. Australasiæ*) As far as my limited experience goes, the first named, the American Cockroach (Fig. 32) is the common species in Ontario. Full grown specimens are about an inch in length, of a light brown color, and furnished with ample wings in both sexes. It is a native of this continent, having originated in the warm regions of the south and gradually spread northward ; it is especially abundant in the Middle and Western States, its place being taken in the Atlantic States by one or other of the imported species.

The German Cockroach (Fig. 33) is more familiarly known under the name of the "Croton Bug," from its association with the Croton waterworks system in the city of New York. It had, no doubt, been introduced into the city long before, but had not attracted general attention till the extension of the waterworks and the immense

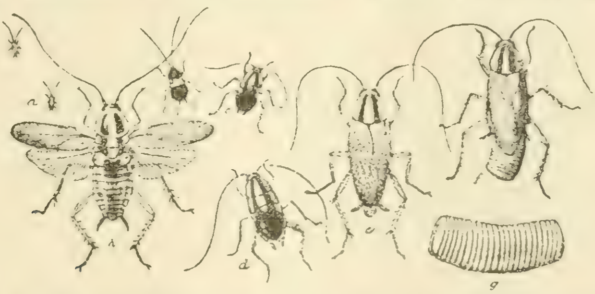

Fig 33. The German Cockroach ; *a* first stage ; *b*, *c*, *d*, second, third and fourth stages ; *e* adult ; *f* female with egg-case ; *g* egg-case enlarged ; *h* adult with wings spread. All natural size, except *g*. (After Riley).

multiplication of piping in houses enabled it to make its way from one building to another without difficulty, and the dampness and heat of hot water pipes afforded it the most favorable conditions for living and increasing. As its name indicates, it is a European species, being particularly abundant in Germany and the adjacent countries. It has, however, been carried by commerce and emigrants to all parts of the world, and is now spreading so rapidly in England, owing probably to the immense importation of goods "made in Germany," that Miss Ormerod tells us it is supplanting the familiar English species, known as "the black beetle." It is much smaller than the other domestic species, rarely exceeding five-eighths of an inch in length, very light brown in color and distinctively marked on the thorax with two dark brown stripes. It is more active and wary than the larger species and much more difficult to get rid of ; it also multiplies much more rapidly, the breeding period being shorter and a greater number of eggs being produced at a time.

The Oriental cockroach is the common species in England, where it is known in the household by the name of "the black beetle." It is supposed to be of Asiatic origin, and to have spread through Europe several centuries ago. It is very dark brown, almost black, in colour, shining, and much stouter than the other species. The wings of the male are shorter than the body and in the female are so abbreviated as to render her practically wingless. It is notably gregarious in habit, the individuals living together in colonies in the most friendly manner. This species was brought in early days to the British settlements in North America and is very common now in the Eastern States ; it has also spread far inland, and has been found even in New Mexico

The fourth species, the Australian, resembles very closely the American cockroach, but may readily be distinguished from it by the bright yellow band surrounding the prothorax and the yellow dash from the shoulder on the sides of the upper wings. It is very abundant in Florida and some of the southern states, but is not likely to become acclimatized in Canada. A specimen was sent to me last summer by a lady in Toronto who had found it among some bananas. It is the only living specimen that I have seen in this country, and evidently came with the fruit from the tropics.

The structure and life history of the domestic cockroaches are thus described by Mr. Marlatt: "They are uniformly dark brown or dark coloured, a coloration which corresponds with their habit of concealment during daylight. They are smooth and slippery insects, and in shape broad and flattened. The head is inflexed under the body, so that the mouth parts are directed backwards and the eyes directed downward, conforming with their grovelling habits. The antennæ are very long and slender, often having upwards of 100 joints. The males usually have two pairs of wings, the outer somewhat coriaceous and the inner ones more membraneous, and once folded longitudinally. In some species the females are nearly wingless. The legs are long and powerful, and armed with numerous small bristles or spines. The mouth parts are well developed, and with strong biting jaws, enabling them to eat all sorts of substances.

"The cockroach in its different stages from egg to adult shows comparatively little variation in appearance or habits. The young are very much like the adult, except in point of size and in lacking wings. In their mode of oviposition they present a very anomalous and peculiar habit. The eggs, instead of being deposited separately as with most other insects, are brought together within the abdomen of the mother into a hard, horny pod or capsule which often nearly fills the body of the parent. This capsule contains a considerable number of eggs, the number varying in the different species, arranged in two rows. When fully formed and charged with eggs the capsule is often partly extruded from the female abdomen and retained in this position sometimes for weeks or until the young larvæ are ready to emerge. The capsule is oval, elongate, or somewhat bean shaped, and one of its edges is usually serrate. The young are in some instances assisted to escape by the parent, who with her feet aids in splitting the capsule on the serrate side to facilitate their exit. On hatching, it is said, the young are often kept together by the parent and brooded over and cared for, and at least a colony of young will usually be found associated with one or two other individuals.

"They pass through a variable number of moults, sometimes as many as seven, the skin splitting along the back and the insects coming out white, soft, but rapidly hardening and assuming the normal colour. Their development is slow, and probably under the most favourable conditions rarely is more than one generation per year produced. The rate of growth depends largely upon food and temperature, and under unfavorable conditions the time required for development may undoubtedly be vastly lengthened. The abundance of cockroaches is, therefore, apparently not accounted for so much by their rapidity of multiplication as by their unusual ability to preserve themselves from ordinary means of destruction and by the scarcity of natural enemies."

They will eat almost anything, animal or vegetable, and especially the food materials found in store rooms and kitchens. They will also gnaw boots and shoes, the cloth and leather binding of books, which they sometimes damage very seriously, the paste or sizing used being apparently the chief attraction. In a house that I occupied a few years ago they were very numerous in the kitchen and scullery, and often made their way up to my study on the floor above. One night when I was writing, a specimen climbed up on my inkstand and began to drink the ink. After watching it for some time I killed it, and found the body was completely filled with ink! Evidently nothing comes amiss to them in the way of food.

But besides the loss they occasion by their consumption of supplies, they are almost a greater nuisance from the disgusting odour they leave on everything that they touch, and which cannot be got rid of without vigorous washing with soap and hot water.

Dishes of food left uncovered at night are often utterly ruined in this way by the morning, and their contents have simply to be thrown away.

Remedies.—A clean kitchen, with well-scoured sink and no damp places or neglected dark corners, will usually be fairly, if not entirely, free from these creatures, as the conditions are not favorable to their multiplication. But if they should become established, it is necessary to wage an active warfare against them. First we should recommend a thorough "house cleaning" of the kitchen, pantries and parts adjacent, moving everything under which they could possibly squeeze their flat bodies, and killing all that can be found; then apply powdered borax to all cracks and crevices in the floors, skirting boards, wainscots or walls. This will usually be found effective, and the cockroaches will disappear; but if not fully exterminated at once the powdered borax should be applied again after a short interval. It is, happily, a clean substance, and its use is attended with no unpleasantness.

Another remedy that is highly recommended is the use of Pyrethrum insect powder. This must be fresh and applied liberally to all places frequented by the insects. It is, however, much more expensive than borax, and involves more trouble, as the cockroaches are usually only partially paralyzed by it, and require to be searched for in the morning and destroyed in the fire. If the infested portion of a building can be made air-tight, the insect powder may be burnt and the fumes will penetrate into every crevice and destroy the creatures in their hiding-places; but this plan can rarely be carried out effectively. Instead of burning insect powder, bisulphide of carbon might be evaporated with still more deadly effect; but this is too dangerous a remedy to be employed in a dwelling house.

A simple mode of trapping them has been found very useful. Any deep vessel or jar may be used. Place against it a number of sticks bent over so as to project a very little way into the interior; half fill the vessel with stale beer, for which the insects have a special fondness. In the morning great quantities of dead and dying specimens will be found, which have climbed up the sticks and dropped into the liquid within. By frequent use of a trap of this kind the number of cockroaches on the premises may be very satisfactorily reduced.

House Ants.

Next to the cockroaches, the insects mostly complained of by housekeepers for their depredations upon the domestic stores are what may be called the "House Ants," as distinguished from those that live out of doors and rarely come into dwellings. The

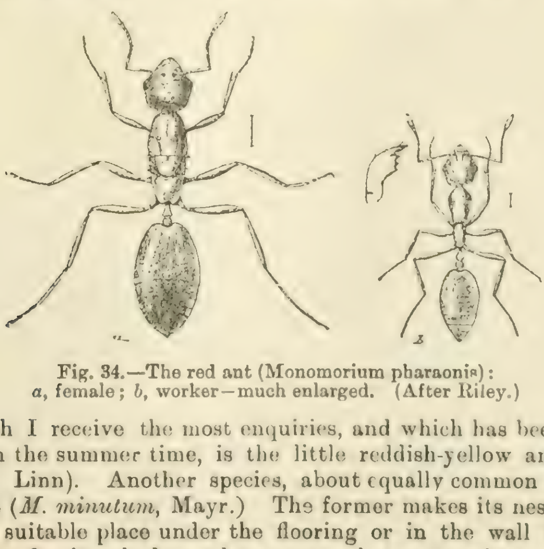

Fig. 34.—The red ant (Monomorium pharaonis): *a*, female; *b*, worker—much enlarged. (After Riley.)

species about which I receive the most enquiries, and which has been very troublesome in my own house in the summer time, is the little reddish-yellow ant (Fig. 34) (*Monomorium pharaonis*, Linn). Another species, about equally common and troublesome is the little black ant (*M. minutum*, Mayr.) The former makes its nest in the house itself as a rule, finding a suitable place under the flooring or in the wall behind the plaster; it sometimes selects for its abode a place near a hot water pipe and in such cases con-

tinues its activity throughout the winter. The black species has its nest out of doors and finds its way in through the crevices of a window frame or some other tiny opening. Both species are annoying, not so much from the amount that they make away with, as from their habit of getting into articles of food, especially sweets of any kind. Frequently the sugar bowl, when brought to table, is found to be swarming with them, or the pot of jam or marmalade that was opened for one meal is full of smothered specimens as well as lively ones when brought out of the cupboard for the next.

It is unnecessary here to enter into any description of the marvellous life-history and habits of ants. Many most interesting books have been written upon their highly organized societies and their remarkable intelligence, among these may be mentioned the works of Dr. McCook and Sir John Lubbock. We are only concerned now to know enough about these tiny species to enable us to deal with them effectively. The individuals that cause the annoyance are all neuters, or workers; the males and females do not appear upon the scene. Should the nest be discovered, there will be found within it one or more females, and a quantity of larvæ and pupæ, which from their white colour and shape are popularly supposed to be eggs. At a certain season of the year, which varies with different species, there may be seen issuing from the nest, apparently in a tremendous state of excitement, a swarm of winged ants, which speedily take flight and from their numbers in the air frequently prove a great nuisance to those whose persons may be covered with them. These winged individuals are males and females, whose marriage takes place in the air. The males soon perish and the females which escape their natural enemies, birds, toads, etc, remove their wings and begin the work of forming new colonies, producing an immense quantity of eggs.

It is evident that the destruction of the workers that come into the house will not exterminate the colony to which they belong. It is therefore all important, if possible, to discover the nest. This may often be done by following the line of advancing and retiring workers till they are traced back to their abode. If at all practicable, without injury to the house, the nest should be destroyed by pouring into it some coal oil or boiling water; where this cannot be done, it may be possible to inject a small quantity of bi-sulphide of carbon, but care must be taken not to have any light near for fear of an explosion, and to air the apartment thoroughly afterwards. In the case of the little black ant, it is often much more difficult to find the nest in consequence of its being out of doors, but when found its destruction is usually an easy matter as it may simply be drenched with coal oil. Failing the discovery of the nest, the only effective mode of getting rid of the nuisance is to entrap aud destroy the ants as fast as they appear. This can readily be done by taking a wet sponge from which the water has been squeezed and sifting fine sugar into it; lay it on a plate or saucer where the ants are in the habit of congregating, and in half an hour or so it will be found full of ants; drop it with its living contents into boiling water and get rid of one host of invaders; repeat the operation from time to time and in a few days the ants will cease to be troublesome. They will, however, appear upon the scene again after some time, when the same process will have to be repeated; but it requires but little time and the expenditure of no large amount of patience.

While housekeepers complain of these tiny ants, gardeners often make enquiries regarding the destruction of the much larger species which disfigure lawns by the great mounds they construct over their nests. A very easy and expeditious method is to be found in the use of bi-sulphide of carbon. Last summer I completely exterminated three colonies on my lawn in the following manner: I purchased a two ounce vial of the bi-sulphide, and at dusk in the evening, when the ants had returned home from their foraging expeditions, I poured about a third of it down the principal openings into the nest and at once covered the whole with a sheet of brown paper. After about ten minutes I set fire to the paper, which caused a series of explosions to take place within the nest. The next morning not a single ant was to be seen, and the mound was easily flattened down. The scorched grass soon recovered, and in a week or two not a trace of the unsightly nest remained. The other two nests were destroyed during the same evening and in a similar manner.

Mosquitoes.

No insect causes so much annoyance and actual suffering to the human race as the Mosquito. It is everywhere prevalent in the summer time and in many localities is so excessively abundant as to be an intolerable pest. Though only active in warm weather it seems that no amount of cold will destroy it. It occurs in prodigious numbers in our Northwest Territories, and, if the travellers' tales from the Yukon and Klondike may be credited, it swarms within the Arctic Circle in such myriads that human beings can hardly live under its overwhelming and incessant attacks.

Though so common an insect and so obtrusive in its onslaughts upon entomologists as well as upon ordinary mortals, it is a remarkable fact that almost nothing was known about the American species till they were recently studied by Dr. L. O. Howard, of Washington, and the results of his observations were published in the volume mentioned at the beginning of this paper. Writers have been content to quote the descriptions given by Réaumur of a European species, which he studied at Paris one hundred and fifty years ago, and have taken for granted that his careful and accurate records made in France are applicable, without verification, to the numerous species that inhabit North America. That the species are numerous, notwithstanding the general practice of speaking of "the Mosquito" as if there were but one kind from the Atlantic to the Pacific, is shown by the fact that Mr. Coquillett has determined twenty distinct species in the collection of the National Museum at Washington, and there is good reason to believe that not half the existing species are represented there.

Fig. 35.—Female mosquito (*Culex pungens*), side view—much enlarged. (After Howard.)

Dr. Howard has made *Culex pungens* (Fig. 35) a species common at Washington, the subject of his special studies, and we may present here a condensed account of his history of its life as being typical of any species with which we may be troubled. The eggs are laid on the surface of water in masses containing from 200 to 400. As seen from above, the egg-mass is gray brown; from below silvery white, the latter appearance being due to the air film. The eggs laid during the night began to hatch at two o'clock in the afternoon of the same day during warm weather towards the end of May, but in cooler weather they sometimes remained unhatched until the second day.

The larvæ (Fig. 36) issue from the under side of the egg masses and are extremely active at birth. In general they pass through apparently three different stages, reach maturity and transform to pupæ in a minimum of seven days. When nearly full-grown their movements were more carefully studied as they were more easily observed than when newly hatched. At this time the larva remains near the surface of the water, head downwards, with its respiratory siphon, which takes its origin from the eighth abdominal segment at the exact surface and its mouth filaments in constant vibration, directing food into the mouth cavity. Occasionally the larva descends to the bottom but never remains below the surface for more than a minute at a time. In ascending it comes up with an effort, with a series of jerks and wrigglings with its tail, but descends without difficulty, its specific gravity seeming to be greater than that of water.

The pupa (Fig. 36) differs from the larva in the great swelling of the thoracic segments, and in this stage the insect is lighter than water. It remains motionless at the surface and when disturbed does not sink without effort, as does the larva, but is only able to descend by a violent muscular action. It wriggles and swims as actively as the larva, and soon reaches the bottom of the vessel or breeding-place. As soon as it ceases to exert itself, it floats gradually up to the surface of the water again. The air tubes no longer open at the anal end of the body, but through two trumpet-shaped appendages on the thorax, from which it results that the pupa remains upright at the surface, instead of with the head downward. This reversal of position enables the adult insect, which issues from the thorax, to support itself on the floating skin while the wings are expanding.

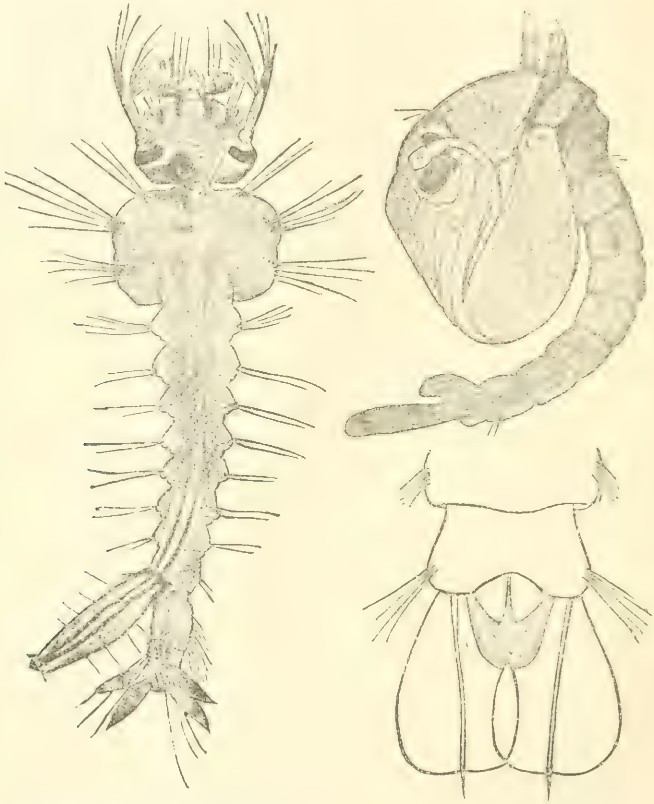

Fig. 36.—Full-grown mosquito larva (*Culex pungens*) at left; pupa at right above, its anal segment below—all greatly enlarged. (After Howard).

The shortest time observed for the life of the insect from the laying of the egg to the emergence of the winged mosquito was ten days, during hot weather at the end of June; but the length of time which is required for a generation may be indefinitely prolonged if the weather should be cool. The extreme shortness of this June generation is significant, as it accounts for the fact that swarms of mosquitoes may develop upon occasion in surface pools of rain water, which may dry up entirely in the course of two weeks, or in a chance bucket of water left undisturbed for that length of time.

The insect passes the winter in the adult winged state and frequently resorts to cellars and out-houses for the purpose. The degree of cold seems to make no difference to their successful hibernation, as may be understood from their abundance in the extreme north.

It is a well known fact that the adult male mosquito does not necessarily take any nourishment, and that the female cannot depend upon the blood of warm-blooded animals for its food. Mosquitoes undoubtedly feed normally on the juices of plants, and not one in a million ever gets an opportunity to taste blood. When we think of the enormous tracts of marsh land into which warm-blooded animals never penetrate, and in which mosquitoes breed in countless numbers, the truth of this statement becomes apparent.*

Remedies.—To prevent the annoyance of mosquitoes in houses, particularly in bed-rooms, it is a good plan to burn a small quantity of pyrethrum powder, about enough to cover a fifty cent piece, heaped up in the shape of a cone and lighted at the top; this will suffice for an ordinary sized bed-room. The fumes penetrate to all parts of the room and stupify the insects for some time. Should they revive, the operation may be repeated. Of course the door and windows should be closed for the time being in order to prevent the escape of the smoke from the burning powder. A quiet night may also be secured by killing all the mosquitoes that are to be found resting on the walls and ceiling of the room. The latter may be reached by tacking the lid of a small tin box to the top of a sufficiently long stick and putting into it a spoonful of coal oil. If this cup is shoved under a mosquito on the ceiling it will at once try to escape, and in its efforts fall into the coal oil and end its existence.

A far more important matter, however, is the destruction of the larvæ, or the abolition of their breeding-places. In our Annual Reports for 1892 and 1893, papers by Dr. Howard were published in which he gave most interesting details of his experiments with coal oil for the destruction of mosquito larvæ. It need, therefore, only be mentioned here that the method consists in pouring a thin layer of coal oil over the surface of the water in which the insects are breeding. The larvæ and pupæ, we have seen, live almost entirely at the surface of water and cannot remain beneath for more than a minute at a time. The coal oil will at once fill up their breathing tubes and cause immediate death. Large numbers also of the female mosquito will be destroyed before their eggs are laid, as it has been found that the coal oil does not deter them from trying to deposit their eggs on the surface of the water. This method, of course, can only be employed in the case of pools of stagnant water of no very large dimensions. When the breeding-place of the mosquitoes is too extensive to admit of this treatment, their numbers can be kept in check by the introduction of small fish into the waters. But the most fruitful places for the production of these pests on a large scale are swamps and marshes. Nothing but their drainage, which may prove a profitable undertaking for other purposes, will suffice for a cure. Rain water barrels and similar receptacles, which are common about houses in the country, produce swarms of mosquitoes during the summer and these readily find their way into the rooms so close at hand. All such vessels for holding water should be kept closely covered, especially at night, when the female mosquitoes resort to them for the purpose of laying their eggs.

Fleas and Bugs.

The consideration of the blood-thirsty mosquito leads one on to think of other insects that have similar evil propensities and that sometimes become a torment to suffering humanity. Fleas are now rarely met with in the older settled parts of Canada, though they were common enough thirty years ago; occasionally, however, a house may be found to be infested with them. Dr. Howard states that the species most frequently sent to the Department at Washington from cities in the Eastern States proved to be the cosmopolitan flea of the dog and cat (*Pulex serraticeps*), and not, as was supposed, the human species (*P. irritans*). This accounts for the rarity of these pests in well-ordered houses where the dogs and cats are kept clean.

*For many interesting particulars regarding mosquitoes, see a paper by Mr. J. A. Moffat in the 24th Annual Report, 1893, page 43.

Fleas (Fig. 37) belong to the order Siphonaptera, a name derived from the sucking apparatus of the mouth and the absence of wings in the adult insect. The body is oval and greatly compressed, allowing the insect to move freely between the hairs of the animal upon which it lives; it is also very hard and smooth, enabling the creature to slip away from between the fingers of its captor or the teeth of a dog. Its escape is also facilitated by its long and powerful legs, which enable it to leap an immense distance when compared with the size of its small body. Its eggs are laid between the hairs of the infested animal, but are not fastened to them, so that when the animal moves about or lies down they are shaken off to the floor or ground. The larva, which is very minute and rarely seen, except by those who search for it for purposes of study, lives upon the animal and vegetable matter contained in the dust to be found in the cracks of floors or the sleeping-places of animals. The frequent sweeping and scrubbing of the rooms in well-ordered households is, no doubt, an effectual preventive of their development.

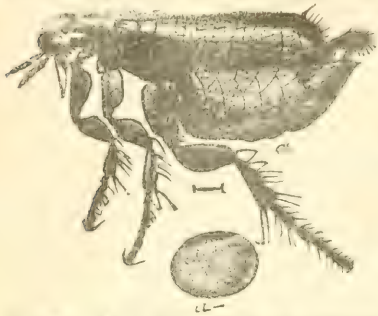

Fig. 37.—Adult flea (*Pulex serraticeps*): *a*, egg, both much enlarged. (After Howard).

Remedies.—Should a dog or cat be found to be infested with fleas it should be thoroughly dusted with insect powder, and its sleeping place turned out and cleaned. Any bedding it has lain upon should be burnt and fresh material such as straw or shavings, be supplied and frequently renewed. The kennel should also be washed inside with some coal oil or benzine. If any rooms in a house are infested, the carpets or rugs should be taken up and thoroughly beaten and shaken out of doors and the floors scrubbed with hot soap and water. An ingenious plan for exterminating the lively adults was adopted by a Professor in one of the buildings of Cornell University. He tied sheets of sticky fly-paper, with the sticky side out, around the legs of the janitor of the building and kept him walking for some hours up and down the floor of the infested room. Nearly, if not all, the fleas jumped on his ankles, as their invariable habit is, and were caught by the fly paper!

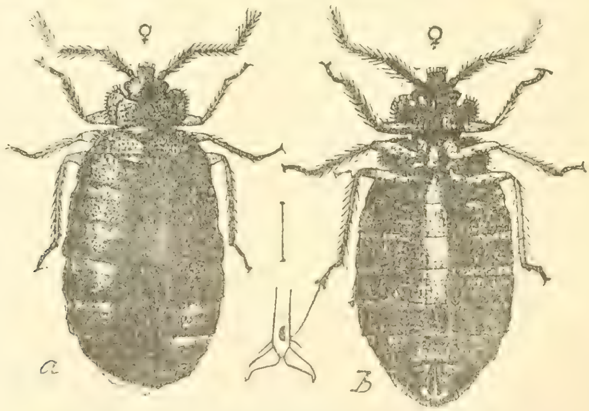

Fig. 38.—*a* Female bed-bug (*Cimex lectularius*) gorged with blood; *b* same, from below—much enlarged (after Marlatt).

The Bed-bug (Fig. 38) is, unhappily, a well-known pest all the world over, and though usually confined to houses of the meaner sort where cleanliness is not regarded as a virtue, it frequently finds its way into well-ordered households, to the great dismay and horror of the inmates. It belongs to the order Hemiptera, which includes the true bugs, a race of insects provided with a piercing and sucking beak, and usually furnished when fully grown with two pairs of wings, the first pair of which are thickened at the base like

the wing-covers of beetles, but only covering about half the back, the remainder being thin and membranous. The bed-bug, however, is destitute of wings, otherwise it would probably be a far more common pest than it is ; in colour it is reddish brown ; the body is round or oval in shape and very flat, so that it can easily crawl into cracks or crevices in furniture, walls or floors. The writer has on several occasions been compelled to deal with these disgusting creatures, when occupying for the first time some premises that had been previously inhabited by dirty, careless people. Once it was a cottage containing four or five rooms that was intended as a dwelling for a laundress and her family. It was found to be swarming with bugs. The windows, doors, etc., were stopped up and made as air-tight as possible, and then powdered sulphur was set on fire in an iron vessel in each room and left till the following day. This was repeated two or three times ; the house was then thoroughly scrubbed and the walls freshly papered. It was a great satisfaction to find that the method adopted was perfectly successful and not a single bug was afterwards seen. In the case of furniture, especially wooden bedsteads, the best plan is to apply benzine or coal oil to all joints and crevices which may harbour the insect, and repeat the operation till there is no doubt of its extermination. The benzine may be forced into the crevices by means of a fine syringe, or with a small paint brush. The liberal use of hot soapsuds to all woodwork is also of very great value.

Among other household insects one of the worst pests is the Clothes Moth, a full account of which was given by Dr. Fletcher in our Twenty-third Annual Report, 1892, page 53 ; it is unnecessary therefore to deal with it here The Cheese or Meat Skipper, a serious trouble at times in the larder, has also been recently discussed by Miss Mary E. Murtfeldt in the Twenty-fourth Annual Report, 1893, page 98.

Library pests are not a serious trouble in Canada so far as I am aware, but in more southern and damper climates they are often very destructive. It was highly gratifying to learn a few months ago that the annual reports of the Entomological Society of Ontario had been the means of saving the public library at Hamilton, Bermuda, from a threatened destruction. During the winters of 1892 and 1893 I had the pleasure of spending a few weeks in those delightful isles, and on each occasion was kindly welcomed by Mr. F. T. Frith, the librarian. He was much distressed by the abundance of a "book worm" which was doing much damage to the bindings and the inside of the backs of many of the volumes in his charge. The insect was evidently a species of *Lepisma*, commonly called "the silver fish," from its peculiar form and scaly body. At the time I recommended the use of insect powder as a possible preventive, though it could not be very conveniently used without the risk of soiling the books to some extent. As a result of my visits our annual reports have been regularly sent to the Bermuda library, and Mr. Frith now tells me that he has carried out with complete success a method of destroying the insect that he learnt from these pages. In the Twenty-fourth Report, 1893, page 94, there is an article on "Fumigation with bisulphide of carbon for the complete and rapid destruction of the insects which attack herbarium specimens, furs, woollens, etc" and a description is given of a fumigating chest for the purpose. Mr. Frith adopted the plan and had several wooden chests made, lined with zinc, carefully soldered at all joints. Around the upper edge of the box a gutter of zinc was made and filled with water, into this falls a flange of metal from the lid and thus the box is perfectly sealed and no air or vapour can pass through. In these boxes he placed as many books as they would hold and on the top of them an open vessel of bisulphide of carbon. The liquid soon evaporates and the vapour, being heavier that atmospheric air, gradually penetrates to the bottom. The books were left in the chests for a day or two, and then they were replaced by others, until the whole of the library was gone over. The operation has proved thoroughly successful and now no obnoxious "book-worms" are to be seen, whereas formerly scarcely a volume could be opened without finding one of these creatures. Thus has the Entomological Society of Ontario saved from destruction the public library of Bermuda !

ON THE ENTOMOLOGICAL RESULTS OF THE EXPLORATION OF THE BRITISH WEST INDIA ISLANDS BY THE BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

By L. O. Howard, Ph. D.

The extremely interesting and important work which is being done under the auspices of the British Association for the Advancement of Science, in the way of an exploration of the fauna and flora of certain of the West India Islands, has attracted a great deal of attention in this country. The comparatively large sums of money at the disposal of the British Association enable it to carry on many lines of investigation of greater or less importance. To working zoologists, however, the Association has never done anything of greater importance than the present investigation.

In 1887 the first appropriation of £100 was made by the Association. In 1888 the committee in charge of the work co-operated with the sub-committee of the Government grant committee of the Royal Society, and an additional appropriation of £250 was made. That year, as a preliminary step, a bibliography of the published writings on the fauna and flora of these islands was published in the Report of the British Association. In 1889 Mr. F. du Cane Godman, who has done so much good by his survey of the fauna and flora of Central America, co-operated with these committees by sending Mr. Herbert H. Smith, the well known American collector, at his own expense, to St. Vincent. The Association this year made a further grant of £180. In 1890 Mr. Smith had already collected and sent in 3,000 insects from St. Vincent, and the announcement was made that Mr. Godman had continued his employment and sent him to Grenada. At the close of the year 1891 investigations had been made in Dominica, St. Lucia, Barbadoes, St. Vincent, the Granadines, and Grenada. In 1892 the reports upon the insect material began to be published. Practically the material in hand in entomology consists of Mr. Smith's collections, covering a period of two years or more in the islands of St. Vincent and Grenada. These islands are respectively the next to the northern-most and the southern-most of the group known as the Windward Islands—St. Vincent lying directly south of St. Lucia, and Grenada forming the bottom of the chain of the lesser Antilles, bounding the Caribbean sea. Grenada lies only about seventy-five miles from Trinidad, and Trinidad, as is well known, possesses practically a South America peninsula fauna. The careful survey of the results of the collections upon these islands, therefore, should reveal many interesting facts regarding the distribution of species, the most important of which will be the determination of the continuation of the Central American fauna, which holds, as we know, in the main, for the larger West India Islands, running from Yucatan and Honduras through Cuba, Jamaica and San Domingo. Does this fauna persist down through the lesser Antilles, or do we have in these extreme islands a fauna more similar to that of the closely adjacent coast of South America, or is there a coast fauna common to these islands and the entire coast-line of South and Central America ?

In these investigations the British committee has shown an energy and catholicity of spirit very much to be admired, and which is quite in common, it seems to me, with the general trend of British scientific work. The smallness of their own home island and the thoroughness with which the insects are known has driven British entomologists to all quarters of the globe in search of new material. The British systematists in entomology to-day are concerning themselves with collections from all sorts of out-of-the way places. Wherever the British traveler goes (and the British are famous travelers), a collection of insects is apt to result, and there is usually in England some worker who is ready to undertake the description of the new forms. This is particularly the case with the larger and better known orders, Lepidoptera and Coleoptera. Outside of these groups the committee has found it desirable to ask the assistance of foreigners, both on the continent of Europe and in America. The material has been thus distributed in the hands of many entomologists and the work of describing and classifying goes merrily on. Already, although as previously stated, it was only in 1887 that the investigation was first begun, papers have been published by Lord Walsingham on the Microlepidoptera ;

by Simon on the spiders; by Bruner von Wattenwayl on the Orthoptera; by Uhler on the Hemiptera; by Forel on the ants; by Matthews on the Trichopterygidæ and Corylophidæ; by Peckham on the Attid spiders; by Kirby on the dragon-flies; by Gahan on the Longicorns; by Champion on the heteromerous Coleoptera; by Williston on the Diptera; by Waterhouse on the Buprestidæ, and by Ashmead and Howard on the parasitic Hymenoptera. There are papers in preparation by Blandford on the Scolytidæ; by Butler and Hampson on the Heterocera; by Champion on the Elateridæ; by Gahan on the Phytophaga and Lamellicornia; by Kerremans on the Buprestidæ.

I have been much interested in examining all of the papers which have been so fa published on the insect collections I have seen them all, except Dr. Williston's "Dipter of St. Vincent," which, although just published, has not yet reached me, and a paper by Warren, on "New Genera and Species of Geometridae," in which, I learn from the Zoological Record of 1894, no less than 170 new genera have been proposed. The remaining papers cover a rather large field, including groups of Coleoptera, Lepidoptera, Hymenoptera, Heteroptera, Hemiptera, and Arachnida, although in no one group have the entire results appeared.

A brief summary shows that exclusive of the two papers just mentioned, 1472 species have received consideration up to the present time. Of these 789 are new to science while 683 have previously been described. These 1472 species are distributed in 836 genera, of which 75 are new. What a notable contribution to science we have, even at the present time!

In attempting to summarize the conclusions of the different authors in regard to the character of the fauna considerable difficulty is experienced. In many of the groups descriptive work is not enough advanced to allow accurate generalizations and in others certain of the workers have seemed indifferent to the broad interest attaching to this side of the investigation. In Mr. Champion's work upon the Heteromera it is stated that all of the genera except four are common to Central America, and all except eight have been found in South America. Ten are common to Central America, but he states, in general, that taken as a whole, the material studied by him shows a considerable affinity with the fauna of the northeastern parts of South America. The number of endemic genera are very few and the endemic species closely allied to the South America forms. As a result of Uhler's studies of the St. Vincent species he shows that the collection of Homoptera "is an assemblage of forms, mostly small and neat, which offer a striking contrast to the large and showy insects that inhabit the regions of the South American continent, a few hundreds of miles away. It is not, however, to this nearest part of the continent that we must look for the source of distribution from which this assemblage was derived. The Mexican character of the fauna seems unquestionable." In his consideration of the Heteroptera of Grenada he says that "the hemipterous fauna is Central American. It is largely composed of forms which belong to the borders of the tropics, rather than of such distinct tropical ones as inhabit the South American continent" Lord Walsingham, in his consideration of the micro-Lepidoptera, says that the forms are decidedly American, ranging northward to the southern and western portions of the United States and southward as far at least as Brazil; "the majority, however, certainly belong to the truly Central American fauna." In this sentence however, Lord Walsingham speaks of the West Indies as a whole, when, as a matter of fact, of the forty six species which he describes from St. Vincent, thirty-eight were new while two had previously been found in Brazil, four in the United States, one in Venezuela and two were cosmopolitan. Of the species studied by Mr. Simon from St Vincent, about eighty per cent are new, although a considerable number of the novelties were known by him from his own collecting to occur in Venezuela. Of the old species all had previously been found in northern South America, Central America, or southern United States Only two, in fact, range into the United States. Mr. Gahan simply indicates "a pretty close relation between the West Indian fauna and that of tropical America." Dr. Williston writes concerning the Diptera that most of the forms were minute and consequently belong to groups that have been but little studied from South to Central America. The relationships he considers to be decidedly South American.

Of the parasitic Hymenoptera described by Mr. Ashmead and myself the condition is much like that mentioned by Dr. Williston. The study of the South and Central American forms is not sufficiently advanced to enable any definite conclusions. Mr. Ashmead is of the opinion that the general character of the collections in the families which he has worked up is Central American, but it is only fair to say that the only South American collections which can be compared are those made in the interior of Brazil by Mr. H. H. Smith.

And this introduces what is probably the pith of the whole question of distribution. We must have full collections from the coast of North and South America, as well as full collections from the interior, with elevations carefully noted, before we can speak authoritatively. It has been suggested that the coast fauna of the entire Caribbean Sea is practically the same and that the tableland further to the interior is also practically the same. That many Central American forms extend through the chain of West India islands is undoubted, but whether the entire character of the fauna from one end of these islands to the other is Central American, yet remains to be proved. The opinions which I have quoted show the uncertainty which yet exists, but it is to be hoped that with the publication of the other papers, and the consideration of the entire results, there may be some satisfactory outcome.

It is gratifying to observe that American systematists are receiving deserved recognition at the hands of the British Committee. No less than eight American entomologists have been or are engaged upon the collections. It is a pity, however, that investigations of this character, so pregnant in possibility of valuable results, cannot be undertaken under American auspices. Our lack of thorough knowledge of the faunas and floras of the many interesting regions within our own domain is apparent to all workers. Our own Association is too poor to make successive grants of the magnitude of those made by the British Association, but the subject is one which should be agitated by all of us. Explorations are being made by the general government and by educational institutions, but in general, although the plants and the larger animals receive a fair degree of attention, the minute creatures, and particularly the insects, are, in the main, neglected.

PROTECTIVE RESEMBLANCES.

BY J. ALSTON MOFFAT, LONDON, ONTARIO.

That the harmonizing of living beings to their surroundings in nature is protective in its influence, does not admit of a doubt, and those who have had the greatest opportunity for observing life in its native conditions are those who are most impressed with the fact. Tropical countries are those where examples of it are most numerous, and probably more striking than in temperate and more northerly regions, for one good reason at least, that life there is more abundant and diversified ; and in insect life especially is this the case. Writers upon the subject draw their most surprising examples of it as a rule from southern sources, yet many instructive illustrations of the same principle can be found in our own country. Everyone that has engaged in the health producing and delightful recreation of collecting and observing the habits of insects during a ramble over mountain and meadow, through wood and marshes, or along a lake shore, can give of his own experience instances of how completely his senses were imposed upon by appearances. A familiar example is the Geometrid larvæ that resemble closely the branch of the tree on which they rest, some of them standing out at an angle from the branch like a bit of broken twig, that requires close observation to make sure that it is not what it appears to be. Or Catocala moths, that are so much like the bark of the tree upon which they are at rest that even a trained eye does not always detect them. When collecting them in the day time I have switched a tree, started one and watched it alight upon another, then got within four feet of it and many a time failed to discover it, although I knew it must be right before my eyes, and had to start it again before I could get another sight of it. So closely at times does the animate resemble the inanimate.

Loitering in a bit of open wood on a hot day, with the mind more active than the body, my eye was arrested by the unusual appearance of a particular spot upon a moss-covered tree. My mental reflection was : How much that bit of moss has assumed the appearance of a moth. I looked closely. It seemed to be a bit of moss only ; I gave it a punch with the end of my cane when a desirable specimen of *Agrotis prasina* fell to the ground, ruined.

Having made the discovery that many of the fall moths rested during the day in the shrivelled leaves remaining attached to the trees and bushes, and that a sharp stroke with a stick would bring them to the ground as if dead, I struck an oak branch, something dropped. I recognized nothing but bits of tinted leaves on the ground, and was on the point of moving on when it occurred to me that it fell too heavily for a bit of leaf, then I looked intently, stooped down and examined closely, when I detected the form of a moth, and such a beauty as I thought I had never seen before ; my first specimen of *Xanthia togata,* arrayed in golden yellow and purplish brown, blending into and harmonizing perfectly with the tints of the decaying vegetation around it.

The first *Cryptolechia Schlægeri* that I came upon, with its pure white patches and dark and light gray mottling, resting conspicuously on the upper surface of a dark green leaf, and its wings so tightly rolled around its abdomen that the thorax and head formed a lump at the one end, whilst it tapered off to a sharp point slightly turned up at the other, I found it utterly impossible in the "dim religious light" prevailing under the leafy dome of a virgin forest, to decide whether it was the dropping of a small bird or an insect. So to settle the question I jarred it into my open umbrella when it rolled down the side without showing the slightest signs of life and I had concluded to dump it on the ground, but when it reached the level it gave a hitch to regain its feet, and it was dumped into my collecting bottle. *C. Schlægeri* was always a rather scarce moth with me ; one and two in a season was usually the limit of my captures, and sometimes a season would pass without my seeing one. Upon one occasion I thought myself in great luck ; I had not been long at one of my hunting grounds when I espied the now well known object in its usual attitude on the surface of a leaf. I secured it and very soon I got another ; whilst looking around I detected at a little distance the indication of a third. I thought to myself, they are plentiful to-day, so moving towards it I was in the act of enclosing it, when my opinion changed. Oh ! That's it, is it ? Ah, well, it can stay there ; it was the reality this time, not the resemblance.

Strolling in a beech wood one sultry day, and feeling oppressed with excessive heat and want of success I sat down upon a fallen tree. Whilst contemplating the surroundings my attention was arrested by what appeared to be some dried beech leaves attached to a fallen branch that was lying about four feet in front of me and about eight inches from the ground. They were of the same bleached-brown color as the leaves that covered the ground everywhere around. They were partially erect, and seemed to be but loosely attached to the dead branch, as they trembled with every passing zephyr, and they had a decidedly ragged appearance. I could not see anything that held them to the branch, there was no spider web visible, yet they remained suspended. I looked and I wondered, and the more I looked the more I wondered, until at last curiosity overcame my disinclination to exertion, I rose and examined, when I found that I had got a perfect specimen of *Cressonia juglandis.* The deceptive appearance was so complete that it had never entered my mind to suspect it to be a living creature of any kind.

These are a few examples illustrative of how resemblance can be protective to the lives of insects against the raids of collectors, but there is a condition that has to be associated with it to render it perfectly effective, and that is complete motionlessness. Let any insect resemble the substance upon which it is resting ever so closely but move, it has exposed its individuality and its doom is sealed. Life is associated in the human mind with motion. In this case the parallel between man and the lower animals is exact. A large proportion of the carnivora prefer to secure their food in a living state, and for that purpose wait to see it move before seizing it. Travellers inform us that lions and tigers of the jungle will not spring upon a motionless object, and that safety

in an emergency may be secured by feigning death. There are families of birds that take their food only on the wing. A fly is perfectly safe within three inches of a toad's nose if it remains still, but let it attempt to secure safety by flight and it instantly ceases to be an independent portion of animate nature. This gives some indication of how important a matter it is for the safety of insect life that they should remain perfectly still.

But there is another important question that has to be taken into consideration in this connection, and that is the condition of the eyesight, and there is a wide diversity in the zoological world in this matter, from that of the most perfectly developed, to where it is a point in dispute if they have any at all. Yet the ordinary vision of every portion of it is nicely adjusted to its needs. That man's eyesight is not all that he would like is made abundantly plain by his invention of the telescope and microscope, and his constant effort to improve and extend their powers, and that the vision of many of the lower animals does not even reach his is undoubted. The question has often been discussed whether insects have any consciousness of form and color. I am quite certain that a humming bird does not know a man from a post if he remains perfectly still. I have had a Pewee come in contact with the hand that was holding a bottle against a tree in its eagerness to secure a Catocala fluttering within, seemingly wholly unconscious of my presence. Many a time when resting in the woods has a ground squirrel come out of its hole close by me. It seemed to realize at the first glance that there was something unusual there, but whether there was danger in it or not it could only discover by investigation, so with that object in view it would come cautiously toward me and would approach so close that I have thought it would climb upon me if I could have kept perfectly still, but my breathing would excite its suspicion. We have the testimony of sportsmen that it is movement that excites alarm in game and makes it seek safety in flight, not the form of the hunter. Hence the utter worthlessness for the purpose intended of those hideous objects we see erected in fresh sown grain fields, and called "scarecrows." They lack motion, or it is of a rythmical order, and observation soon leads to the conviction that there is no danger in their presence, then familiarity breeds contempt. So then motion is regarded as a sign of life throughout the whole animal world, whether it be in the securing of proper food on the one hand, or as a warning to escape from the feeders on the other, and motionlessness is one of the best means of defence against those that are seeking life to take it, and in the insect world it plays a most important part.

But if insects have very defective eyesight as judged by our standard, they have a complete advantage over us in the faculty of scent. Their power of locating their mates is well known and phenomenal. One example more. Being in an open wood on an early November morning with a light fall of snow on the ground, I saw two moths about forty feet in front of me and about thir y feet apart flying towards each other. I hastened forward to see what they were. They passed out of sight behind a tree about four feet from me ; I stepped round it, one of them flew away, the other was secured by the wingless female of an Anisopteryx. And it is quite reasonable to suppose that this faculty is of advantage to them in other respects, such as in securing their food and in deciding upon the correct location for ovipositing. There are certain ichneumons that confine their attention exclusively to some particular kind of larvæ If they have no power to distinguish between the form and color of the various kinds of caterpillars, then it must be by scent that they are guided in their choice, whilst movement on the part of the larvæ would enable them more readily to locate the object of their search.

There is now the question of how much can be learned from observation and experience. We know how much man is indebted to it for his knowledge and wisdom. Practice will enable one person to detect an object where one without it would see nothing ; it also sharpens the faculties to distinguish between things that differ, and to the very last he is gaining knowledge by means of it. Many of the lower animals can be educated to some extent in a similar manner, and many of them have been brought to exhibit a wonderful degree of intelligence in that particular direction to which they are naturally inclined, and there can be little doubt but many of them in a state of nature acquire considerable knowledge in their life time, how best to conduct their

affairs in the condition in which they find themselves placed. The ground squirrel gave unmistakable evidence of being possessed of memory, which is the foundation on which education is built, hence it is capable of being instructed up to the limits of its faculties. How far short-lived insects that come into the world thoroughly under the control of a few desires which they devote their whole time and energies to the gratification of, and whose faculties at the moment of their birth are complete for all the requirements of their existence, do, or can acquire further knowledge by experience for the better ordering of their lives, is a good deal of a problem yet to be solved. I am aware that there is a doctrine of "cumulative mental inheritance," but into that I do not enter. A peripatetic professor gave a lecture upon the "occult sciences." At least, said a reporter, that is what he was advertised to lecture upon. but it is doubtful if there was one in the audience that knew what he was talking about. But then, added the reporter, it is doubtful if the lecturer had the slightest advantage over the audience in that respect.

NOTES ON THE SEASON OF 1897.

By J. Alston Moffat, London, Ont.

The weather here during the past summer was of a decidedly unusual character The spring opened finely, but May and June were uniformly cool with frequent rains, vegetation progressed steadily but very slowly. July maintained its character for heat, a succession of excessively hot days in it, with heavy showers throughout the month. August was uniformly cool with less rain, and some light frosts at its close; whilst the first part of September was warm, it closed with killing frosts, and the month was excessively dry throughout. Such conditions had a marked effect on insect life, retarding and confusing the appearance of many species, whilst it would no doubt be the means of destroying numbers of them. The ordinary cut-worm moths were present to some extent, but none of them were reported here as being noticeably destructive. The army-worm seems to have retired again to its usual obscurity; but there were plenty of the moths about the lights late in the season, to keep the breed alive, and be ready to produce a future outbreak when the conditions are specially favorable. The frequent rains seemed to have a disastrous effect upon the web-worms, as at no time during the season were their offensive-looking tents at all conspicuous. During the early part of September I noticed the clover-leaf weevil, *Phytonomus punctatus*, Fab, in considerable numbers on the streets of London, indicating that someone's clover had been suffering in this neighborhood. Whilst on a visit to Essex, I saw in the collection of Mr. E N. Laing a Tobacco sphinx, *Protoparce carolina*, Linn, which he had reared from the caterpillar, and as tobacco is now being grown quite commonly in that region as a regular commercial crop, this species may yet become abundant. In a school collection made not far from London, under the superintendance of the teacher, Mr. J. W. Atkinson, and exhibited at the Western Fair, I saw a specimen each of *Megalostoma* (*Colias*) *cæsonia*, Stall (Fig. 39), and *Terias lisa*, B.L. What a splendid thing it would be for our country if every school teacher was an interested collector in some department of natural history, as his example would give a respectable standing to the habit of observing and taking an interest in those simple objects of nature that are strewn so profusely around us, with all the educational, elevating and refining influences associated with it, and which is such an inexpensive means of securing untold enjoyment to those who engage in it. Natural history is now being taught in our schools; to what profit is not apparent. It is set as a task which

Fig. 39.

has to be learned to pass an examination, and when this is accomplished it is thrown aside as having served its purpose. It may be true, and very likely is, that "Naturalists" like "Poets" are born, not made; yet I have known parents to prohibit their children indulging a strong inclination to collect natural history specimens, which they greatly admired and in which they took much pleasure, for fear that it might interfere with their school lessons. And by the time they had left school they had lost all taste for natural history. A young lady whose father is known in his locality as an artist and a geologist, and whose brother stands very high in financial circles, but has also gained for himself a name in geology, told me that she was once at a bazaar when her uncle, her mother's brother, said he would pay for anything she liked to take from a particular table. She choose an odd-looking shell in the rough. He scouted the idea, and wanted her to decide upon something that he thought was of some value. But no; she wanted nothing but that shell; and she wanted it very badly. Then handling and looking admiringly upon her treasure she thoughtfully remarked: "We inherited that propensity." From your father's side, I remarked. Oh! she exclaimed, laughingly, there is nothing of that sort whatever on our mother's side. I knew a woman whose boy was given to collecting natural history specimens, and would take them to his mother and would speak of their beauties or peculiarities, and she would look and listen with apparent interest, but she confessed to me that she could see nothing of what he was talking about in them. She did not let him know. She knew they were to him a great source of innocent enjoyment, the treasures which his heart instinctively turned to, and which drew him to his home, and made it exceedingly pleasant for him to stay there; and she was pleased. Wise woman, if unfortunately defective in her perceptive faculties. A personal collection is what is wanted to give interest and permanence to the study of natural history. Whilst others derive benefit from looking at it, it may help to induce them to begin one also.

Elaborate discourses have been given upon "How to study Natural History." Some of them well calculated to crush out all aspirations in that direction, as they land you at once in a tangle of unintelligible phraseology. We have, I dare say, all heard the directions for, how to cook a hare: "First, catch the hare." To any one who has a desire to obtain some knowledge of the natural sciences in any of its numerous branches I would say, first collect your specimens. That is, such as are conveniently obtainable, which excludes astronomy and seismology. Then examine your specimens, when you will probably learn something about them that you did not know before. This may induce you to look at them again, to discover yet something more. Taste can be cultivated, and the faculty of observation is sharpened by exercise. Then you will likely want to collect more, as your curiosity may have become excited; curiosity leads to inquiry. Enquiry when judiciously exercised leads to knowledge. Knowledge when obtained is gratifying, and in time the pursuit of it becomes a perfect pleasure. And the more you know the easier and pleasanter it becomes to acquire more. Then keep that up, a little now and a little again, and very soon you will find it such a delight that, no matter what your condition or occupation may be, you will find some time and opportunity to indulge in it. And if you are endowed with capacity, endurance and perseverance you may attain to the very highest position in your department; but do not expect to begin there; it is not the rule at school to begin with mathematics and work down to the alphabet.

A professor of natural history in a prominent educational institution wished to obtain transparent wings of insects, such as the Neuroptera or gauze-wings, to make lantern-slides of to throw enlarged upon a screen. These I was much pleased to provide him with, and interesting and beautiful objects some of them made. He also wanted the sting of a bee. It was winter. I said I could give him dried specimens, but he might find it difficult to secure a perfect one from such; but from a fresh specimen it could be easily obtained. How? he inquired. Just squeeze the abdomen and it could be cut off perfect, root and all. And where is it situated, in the mouth? Oh, no, I replied, at the other end. But a mosquito's is, is it not? That man knew a good deal about many things, but he must have commenced to learn about where the people usually leave off. We find many men who seem to have forgotten that they ever were boys; but one would be almost ready to believe that the professor had never been a boy.

My own work during the season has principally been, delightedly observing the results of Mr. Bice's collecting at electric light. I have thought it would be an excellent method of determining the time of appearance of different species; and if they were single or double brooded. I was somewhat surprised to see *Scoliopteryx libatrix* appear in the spring, as I had always regarded it as a strictly fall moth. The specimens were too fresh, and rather late in the season to have hybernated. *Nomaphila noctuella* I have often wondered about. It appeared about the first thing in spring, in a sadly worn and dilapidated condition; clearly indicating that it had been sporting in the grass during the warm days of the previous autumn, and continued without intermission to the end of the season. Mr. Felt, *Can. Ent.*, vol. 25, p. 131, says: "There seem to be three broods a year." But I suspect that the broods must overlap, as they were never wholly absent. In mid-summer they were unusually plentiful, with an endless variety of ornamentation; from a uniform light-brown with numerous dark brown dots, to a yellowish-brown with three heavy dark brown transverse bands on their long narrow front wings.

In the September number of the "Entomologists' Record" is a note on "The Attractiveness of Light," signed W. Grover, Guildford, dated July 9th, 1897, in which, after relating that he had found some colored lights more attractive than ordinary light, enquires "Why is light attractive to the males only of so many species?" This was an idea new to me, although we had been having some experience on that very line without suspecting the cause. In the early part of September, the males of *Tolype velleda* (Fig. 40) were in great abundance, and those of *laricis* in goodly numbers. Mr. Bice had a pair of *velleda* of last year's take, but he wanted females of *laricis*. He knew that the female *laricis* was light like *velleda*, but smaller, and he wanted me to give him the distinguishing marks of female *laricis* when at rest, as he was tired taking male *velledas* in a futile attempt to get the female of the other. This I found it very difficult to do; I could separate them by the antennae and the form of the abdomen, but to give a recognizable discription of the front wings to separate the two, I did not at the time seem capable of doing. So I requested him to get me a lot to see what I could make out of them. He then brought me a bottle full, so I began pinning, spreading and drawing out their antennae, which they keep completely out of sight under their shoulder pads. After filling two setting boards and finding only male *velleda*, I began to get tired. So I pinned the male *laricis*, then turned up to view all the rest, when I noticed two differing from the others in the whiteness of the upper surface and deeper scollops in the dark outer band, so I pinned and spread them and found they had bristled antennae and rounded abdomens, which confirmed my expectations that they were female *laricis*. Being under the impression that the females would appear later, I took Mr. Bice a specimen and pointed out to him how he might recognize female *laricis* when at rest, but he saw no more of them. I also requested him to get me a lot of female *velleda* to go with the males I had spread; he secured one, and could get me no more, when they totally disappeared shortly after. The rule in this case was not absolute, but it seems to point in the same direction as Mr. Grover's experience; and it is well to be warned in such matters what one has to expect, but the query remains, why is it so? It is known that female insects as a rule are less active than males; and in this case it would be quite excusable for such a portly, richly-robed dame, to refuse to join the revelers by night and dance around a light-pole; yet some of them did, but it may be placed to the credit of the sex that they were not the noblest of their kind.

Fig. 40.

Mr. Bice has again secured quite a number of fine moths new to the Society's collection. Those that I have thus far been able to identify are a single specimen of *Thyatira pudens*, Guen. This seems to be a very rare insect in this country. The large spots on the front wings are a silvery white with the faintest tinge of pink. In Guenee's colored figure, plate 3, fig. 1, they are altogether pink. A single specimen of that large and handsome geometer *Selenia kentaria*, G. & R., and perhaps the first

reported from Canada. It is much deeper in the reddish-brown of the underside than is represented in Mr. Grote's colored illustration, fig 5, plate 1, vol. 1, Trans. Amer. Ent. Soc. Phila. A single specimen of *Aplodes rubromarginaria*, Pack. Also one of *Plagodes Kentzingaria*, Pack. One of *Gortyna speciosissima*, G. & R., a particularly attractive species, illustrated on plate 7, fig. 52, vol. 1 Trans. Am. Ent. Soc., Phila Also a sphinx new to Canada, *Dilophonota obscura*, Fab. Dr. J. B. Smith directed me to his description in the "Transactions of the American Entomological Society, vol. 15, page 157, where it is clearly defined. He gives the habitat as, "Pa.(?) Texas, Mexico, West Indies, South America." Then adds, "Easily recognized by the small size, gray primaries and unbanded abdomen. Specimens of this very rarely range northward, and a specimen in my possession was said to have been taken in Pennsylvania. I do not know the source whence I obtained it and I cannot vouch for the locality. It is a southern form." All these were most generously surrendered by Mr. Bice to the Society, and form a valuable addition to its collection. He also took several specimens of that curious little snout moth, *Gaberasa ambiqualis* of Walker, the *Tortricodes bifidalis* of Grote. It has a split in the front wings of the males, fringed like an incipient feather wing. The first one I saw puzzled me greatly, not knowing but it might be only a freak of nature, instead of a characteristic of the species. An appeal to Dr. Smith put me straight, when he also informed me that the wings of the female were entire Both sexes were taken by Mr. Bice. Mr. Grote at first described the females as a separate species, whilst at the same time strongly suspecting that they were but the different sexes of one species. There are a number of Mr. Bice's captures yet to be determined.

NOTES ON THE SEASON OF 1897.

By Rev. Thomas W. Fyles, F.L.S., South Quebec.

The "Notes on the Seasons," published in the Annual Reports of the Entomological Society, of Ontario, will, I think, be found useful to the rising entomologists of our own day, and, in the future will afford material that may be worked into a complete history of the insects of Canada. In this belief I contribute to the store my memoranda on things that have come under my observation during the past summer.

The season was a remarkable one ; the early summer was cold and wet, then came a period of intense heat, which was succeeded by a bright, mild autumn prolonged into November.

Brephos Infans, Moeschler.

On the 24th of April members of the Montreal Branch invited me to join them for an excursion in search of *Brephos infans*, Moesch. We went to a birch wood some distance from Montreal, and soon had the pleasure of seing *infans* on the wing. It flies amid the tops of the birches, making an occasional descent to lower foliage. These descents are the entomologist's opportunities ; but, as the insect has a rapid and uncertain flight, they can be captured only by a lucky stroke, or a well sustained effort.

I left the business of catching to my companions, for, as we advance in years, we lose—to use the words of Alexander Smith—

"——the wild-deer from the blood,
The falcon from the eye."

I sat on a stone and watched my friends dash through puddles formed by melting snow and amidst the scrub on the outskirts of the wood, admiring their zeal.

The expedition was a successful one, and, from a female captured on the occasion, Mr. Dwight Brainerd obtained eggs, from which both he and I succeeded in bringing larvæ to the pupal stage. His notes regarding them will be found in the November number of the *Canadian Entomologist*.

The larvæ I reared were about a week later in their changes than those raised by Mr. Brainerd. This was owing, no doubt, to the difference of climate between Quebec and Montreal. At Quebec the eggs hatched on May the 8th. The larvæ moulted on May the 13th, May the 21st, and June the 2nd, and pupated June the 20th. This species spends probably eight months in the pupa.

Ctenucha Virginica, Charp.

On the expedition above referred to I obtained larvæ of *Ctenucha Virginica*, Charp. which had just aroused themselves from their winter's sleep, and were feeding on the wild grasses in the wood. This is a description of them at the time:

Head reddish brown, sides and back set with pencils of black hairs, a sub-dorsal row of tufts of whitish hairs springing from a white line, spiracular line white; moulted April the 26th.

After Moult, head chestnut red with black face. A frill of white hairs round the head. Distinct black tufts along the back, sub-dorsal lines pale yellow with yellowish tufts, white spiracular line with tufts of whitish hairs, legs red; moulted May the 21st.

Full Grown Larva, one inch in length, head chestnut-red with black face, mouth organs white, a dorsal line of black tufts bordered on either side with a line of yellow tufts, sub-dorsal line yellow, spiracular line white, between them a line of black tufts, under parts black, legs red.

One larva was almost white—the tufts on its back were yellowish.

Of three that I took particular notice of:—

The 1st spun up May the 28th, and the moth appeared June 25th.
The 2nd " June 9th " " July 7th.
The 3rd (the pale one) spun up June 30th, and moth apeared July 18th.

Newly caught females of *C. Virginica* laid eggs which hatched on July 25th. The larval stage of this species therefore extends over a period of ten months or more.

The Case-bearer of the Birch.

In the beginning of May, as soon as the leaves of the birch were fairly opened there appeared upon them the curious habitations of a species of Coleophora. The following is a description of the larvæ producing them:—

Head brown with a pale V-like mark—opening towards the front—and a few white bristles, shield on second segment brown divided by a pale line, small shield on third segment and anal plate brown, claspers brown, general body color brownish-salmon, darker on the back; length on the 24th of May, two-tenths of an inch.

The larval case at first appears as a closely-woven, elongated capsule with little brown tufts in it. The occupant, when it finds this habitation too narrow, selects at the edge of a leaf a portion bordered with two or three serrations. This it hollows out by eating away the parenchyma. Then it works its way in, cuts off the selected portion, and proceeds to unite the free edges, thus making a new tent. It fills up all awkward insterstices with a fine web. Under the microscope the veins and stomata of the skeletonized section of leaf thus appropriated present a beautiful sight.

In feeding the larva bites a round hole in the cuticle of the leaf on one side, and then eats away the parenchyma as far as it can reach on every side without leaving its case entirely.

The larvæ ceased feeding in June, and the moth appeared on July 9th. This is a description of it:—

Colour, pale silvery ash, a tinge of reddish-brown on the after part of the primaries, secondaries narrow, ciliate on both sides, eyes black, antennae beautifully ringed—brown and white, fringes slightly tawny, tibiæ of hindmost pair of legs clothed with long hairs, expanse of wings half an inch, length of antennae three-twentieths of an inch. Length of body, one-fifth of an inch.

Spilosoma Congrua, Walker.

I took a female of this species at the Gomin on the 29th of June. It laid eggs on the 10th of July, and these hatched six days afterwards. The larvæ fed on pig-weed, dandelion and plantain. I succeeded in bringing the whole batch to the pupal stage, and took full notes of all their changes. As soon as the appearance of the moths enables me to complete the life history of the species I will send the particulars to the *Canadian Entomologist* for publication. I may say that the larvæ are very different in all their stages from those of *H. textor*, and seem to indicate that *Congrua* should come in the genus *Arctia*.

Unfortunate Selandria Larvæ.

On the 7th of July I found on a young ash at St. David's a number of milk-white larvæ with black, shining heads, and black feet (*S. varda*, Say ?) They were about three-fourths of an inch long. Next day they moulted, and, after the moult, seemed smaller than before. Their colour was changed to pale lead-colour above and a pale yellow beneath. The head was dark brown above, the face yellow. The legs also were yellow. They fed no more, but became inert and dropped to the ground. The cause of all this became apparent when, on the 23rd of the month, there came from them a number of Tachina flies.

Captures in August.

On the 6th of August, passing through the Fort Woods at Levis, I found a bush of *Spiræa salicifolia* Linn. in full bloom. It was thronged with insects. Without moving from my position I captured *Sannina exitiosa*, Say (Fig. 41). *Conops sagittaria*, Say, *Anthrax fulviana*, Say, *Perilampus ceruleus*, Say, *Philanthus bilunatus*, Cress, *Eumenes*

Fig. 41. Female moth on left, male on right. Fig. 42.

fraterna, Say, *Gorites phaleratus*, Say, *Exetastes rufo femoratus*, Prov., etc., etc.—a great haul! Moths of *Gelechia gallæ-diplopappi*, Fyles, appeared from the 8th to the 15th. *Catocala parta*, Guen. (Fig. 42) was very abundant at the end of the month.

Blisters on Poplar Leaves.

On the 9th of August I found blisters on poplar leaves. Each blister was about half an inch across. It contained a larva which changed to a chrysalis before I could describe it. The chrysalis was attenuated and about three-twentieths of an inch in length. On the 28th of the month it produced a lovely little moth. In length of body this was only one-eighth of an inch. Its wings expanded three-twentieths of an inch. The fore wings were golden brown, and had a set of creamy white patches bordered inwardly with black, and running transversely from either side to the middle of the wing. The hind wings were narrow but deeply fringed. The palpi were white and feathery, the eyes black, the legs were white and had feathered tibiæ. This I concluded was the *Lithocolletis populiella* of Chambers.

More Saw-Fly Larvæ.

On the 9th of August, the light shining on a leaf of *Populus tremuloides*, revealed to me a number of cuts, each about one line in length, on the under side of the leaf. I knew them to be vacated saw-fly cuts, and immediately looked for the young larvæ. On several leaves near by a number of round holes were seen, and looking closely into these I found in every one a black larva extended along the edge inside the opening. When disturbed the larvæ threw up their tails in true Nematus fashion. They grew rapidly, and in the night of August the 14th they threw off their dusky covering, and presented themselves in a splendid new garb of dark navy-blue with black dots, and with large yellow spots in a line with the black spiracles. The head was glossy black. The legs and underside were of a neutral tint. The length of the full-grown larvæ was seven-tenths of an inch.

On August the 20th the larvæ descended and spun loose brown cocoons under the leaves in the bottom of their cage. I obtained from these, on the 8th of September, some very handsome saw-flies, of which the following is a description :—

Length of body, three-tenths of an inch ; expanse of wings, seven-tenths ; length of antennae, two-tenths.

Head black, but with clypeus, hypoclypeal plate, labrum and palpi yellow. Clypeus emarginate rather short. Eyes round and prominent, black. Ocelli black. Cheeks rounded and protruding. Antennae with a somewhat moniliform scape ; the second, third and fourth joints rather long and nearly of equal length, the other four smaller and slightly tapering ; the whole one coloured—black.

Tegulæ and pronotum flavescent ; lateral lobes of scutum dark chestnut-red ; the rest of the thorax and the base of the abdomen black. The abdomen, for the most part, is of a clear, chestnut-red without dorsal markings, but the cerci and ovipositor are black and the last joint is clouded.

The first and second pairs of legs are flavescent throughout. The hind pair have the tibia—except the knee, which is yellow—and the tarsus black. The tibiæ are thickened, and the tarsi end with extended claws.

The wings are beautifully clear, and in some lights iridescent. Their venation is remarkably distinct, and is of the normal type.

Saw-Fly Larvæ on Cornus.

In the beginning of September there were handsome larvæ in great numbers feeding upon *Cornus stolonifera* Mich. and *C. alternifolia* Linn. When they first came under my notice they were curled, helix-like, under the leaves, lying in clusters. The head was glossy black, the body pale yellow ; but down the back were eleven rectangular patches resembling buckles, blue black with yellow centres. There was also a terminal patch, rounded, and of the same colour. The creatures had just changed their skins. They moulted again on the 14th of September. The empty skin was held by the claspers and stood upright. The head-case and second segment were split, and the rest of the skin was intact. The larvæ after the moult were more highly coloured than before. The rectangular markings on the back were deep navy-blue, and the inner mark and dividing lines were pale blue. The yellow of the rest of the body was of a deeper shade. They moulted again on the 30th of the month, and at intervals in October they retired into the earth. I found specimens on the Cornus bushes after the frosts came.

Captures in September.

On the 1st I took *Plusia brassicæ*, Riley (Fig. 45. *a*, caterpillar ; *b*, cocoon ; *c*, moth), and *Petrophora testata*, Linn, at the Gomin. On the 3rd I found *Feltia venerabilis*, Walker ; *Agrotis redimicola*, Morris ; *Plusia brassicæ*, Riley, and *Drasteria erechtea*, Cramer (Fig. 44), on panicles of *Solidago nemoralis*, Ait., in the open fields. On the 11th

Orgyia nova, Fitch, was flying in the sunshine at the Fort Woods, and *Cleora semiclusaria*, Walker; *Plagodes fervidaria*, H. & S.; *Petrophora truncata*, Hbn. (second brood), *and P. diversilineata*, Hbn. (Fig. 45), were plentiful on the boles of spruce trees. On the 22nd *Epirrhita dilutata*, Bork, was out at the Fort Woods. On the 24th *Callocampa curvimacula*, Morris, was abundant at sugar, and *C. parta* was still out but much worn.

Captures in October.

October the 15th was very mild. The thermometer stood at 64° on my verandah at 8 p.m. *Xylina georgii*, Grt., was abundant at sugar. On the 20th of the month a fine, fresh specimen of *Pyrameis Atalanta*, Linn, was taken on the streets of Levis. On the 23rd the wind was in the south, and the day bright and balmy. *Teras ferrugana*, Schif,

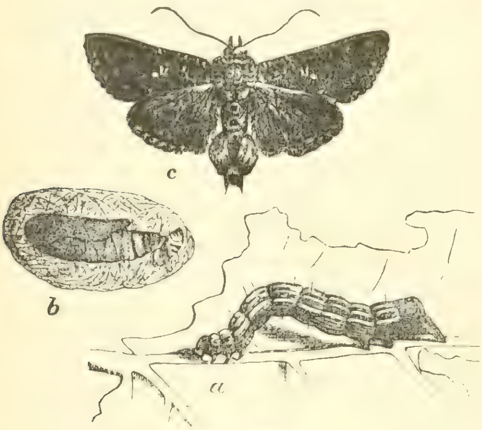

Fig. 43.

Fig. 44.

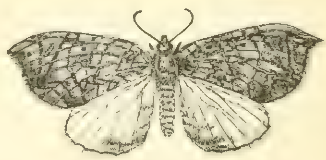

Fig. 45.

was plentiful among the sallows, and *P. fervidaria* was still out. On this day I found the full-grown, onisciform larvæ of *Syrphus ribesii*, Fab, feeding upon *Schizoneura lanigera*, Hausm. They spend the winter in the larval stage, and go into pupa early in the spring. The flies appear in April.

And now the winter storms are come, and we must be content—like schoolboys in their contemplation of the holidays—to think for half the dreary time of entomological pleasures past, and to anticipate in the other half pleasures to come, cheered in the meanwhile by the monthly visits of the *Canadian Entomologist*. May no unkind blizzard detain the mails that convey it!

A FEW NOTES ON THE SEASON OF 1897.

By Arthur Gibson, Toronto.

The season of 1897 in the neighborhood of Toronto was, entomologically speaking, a comparatively poor one, as far as "good things" were concerned. Indeed, most of the commoner lepidopterous insects, especially the butterflies, were rather scarce, and those which are usually scarce were in most cases not to be seen at all.

The season of 1896 was a very good one in this district, several species of lepidoptera having been observed and taken for the first time in this locality.

During the past season the only diurnals which I know of as having been taken in this neighborhood, and which are really worth mentioning are :

Feniseca Tarquinius.—One specimen observed at Forks of Credit on 1st July.

Lycaena Comyntas.—Very rare, only a few specimens taken, one of which I took on 26th June.

Lycaena Scudderii.—Fairly plentiful on and about 15th June, but very local around the food plant,—Lupin.

Pieris Napi.—Two or three specimens of a variety of this butterfly were taken on the 24th May, the only specimens observed.

Last season, on the 1st July, the variety Oleracea-aestiva was very common at the Forks of Credit, but on paying a visit there on the same date this year, not a single specimen was to be seen. In fact, very few butterflies of any species were noticeable.

Papilio Cresphontes.—A worn specimen of this butterfly was taken on the 24th September, at Weston, a few miles from Toronto, by Mr. Donald Wilby.

Collecting by electric light was also very poor this season. I do not know what has come over the Sphingidæ. For the last four seasons they have been very scarce. In 1893 as many as seventeen different species were to be taken, and most of these species were fairly common, while some of them were very plentiful. Deilephila Chamaenerii

Fig. 46.

(Fig. 46) especially was very common in 1893. Even around the electric lights in the heart of the city numbers of specimens of D. Chamænerii were to be taken. During the last two seasons I have not seen a single specimen of this sphinx. Actias Luna was frequently observed this season, and as many as ten specimens were taken on the 27th May. Regarding the other moths which come to light, they were in most cases very scarce.

"Sugaring" also was poor, up to July 1st hardly a specimen being attracted to the sugar. After that date, however, several good noctuids were taken, but up to the present time I have not got them identified.

NOTES ON THE SEASON OF 1897.

By C. E. Grant, Orillia.

The season of 1897 was not a very good one from an entomological point of view, though, as is often the case in such seasons, some good captures were made here in Orillia, of which I made some notes.

Brephos infans was taken by me this year on April 11th for the first time in thirty years. Others were seen at a later date, but were too wild to capture. The locality was a road through a birch woods.

Thecla laeta.—One specimen of this rare insect was taken by my friend, Mr. James Walker, in a cedar swamp not far from a running stream ; the specimen was a female in good case. As the insect was taken on a cedar bush, it would have been interesting to know if this is the food plant of this species. I believe it is not known. I intend, if all is well, to thoroughly search this locality next May for a duplicate. The date of capture was May 12th.

Melitaea Harrisii.—Three specimens of this species were taken in the first days of July beside the railway track passing through a piece of low land. This insect is rare here.

Papilio troilus.—Took my first Orillia specimen of this butterfly on Asclepias in the month of August.

Lycæna comyntas.—This is also an addition to our fauna. The one I took this year was in a clover-patch at the side of the railroad. Date August 4th.

Colias philodice variety *nigra.*—On the afternoon of August 12th I was watching a large number of *C philodice* disporting themselves in a clover field when I was suddenly aware of the presence, amongst them, of a butterfly, which I was sure I had never seen before. I was much puzzled at the time as to what genus it belonged to. After a hard and long chase, and I am afraid to the detriment of the gentleman's clover, I captured it, and

Fig. 47

on examination I at once recognized it from the painting in "Edwards's Butterflies" in one of his places of Philodice. Of course it was not an exact reproduction, the bases of the wings on the underside being darker olivaceous, and the upperside being covered with long greenish hair near the bases, producing a pretty effect ; it was altogether a handsome insect. Philodice was remarkably abundant this season, and the female in great variety. The albino specimens were nearly as numerous as the yellow type, and differed greatly in markings from each other.

Megalostoma cæsonia (Fig. 39).—I searched in vain for this eccentric butterfly this season, which last year was moderately common, but did not see a specimen. It will probably be due again in thirty years, as it is about that length of time since I captured it in my father's garden when a boy.

I had good success among the Sphingidæ, and captured no less than nineteen different species ; most of these were taken at flowers in June and July, from one to three of each, with the exception of *Triptogon modesta* (Fig. 47), which was found at the base of a poplar, newly emerged from cocoon, and some which were taken at light ; the abundance of *Smerinthus excæcatus* (Fig. 48) was remarkable, eight specimens coming into the house one evening in July, attracted by an incandescent light.

The long cold rains that succeeded the hot spell in the beginning of July apparently were too much for most of the destructive cut worms, as their imagoes did not appear (with the exception of *Agrotis telifera*, Fig. 49,) in any numbers. *Hadena devastatrix* and *arctica* and *Leucania unipuncta*, the army worm moth, were almost scarce—in 1896 *unipuncta* was so plentiful that I have killed over 500 on one post, on which I had placed my sugar for other victims ; they were a perfect nuisance, coming in clouds before dark, and this occurred in June and again from the end of July through the season ; notwithstanding this fact, the army worm was not reported as troublesome in our county, though I believe Ontario county was infested to some extent.

Fig. 48.

Fig. 49.

The following noxious insects were reported as plentiful around Orillia :

The tent caterpillar, *Clisiocampa Americana*. Fig. 19, also its confrere (*sylvatica*) the former, however, only lives in the neglected orchards, but the moth was extremely abundant.

The canker worm (*Anisopteryx pometaria*).—I never saw such quantities of this insect in the imago state as this year ; in October it was to be found, male and female, on every roadside fence—with it was also conspicuous *Hybernia tiliaria*, the November moth, Fig. 50.

Carpocapsa pomonella, the apple codling moth,—this insect, though not often seen as an imago, is always plentiful here, but spraying the trees has had a wonderful effect in controlling this pest, and those orchards that are sprayed regularly *every* year produce as sound fruit as is to be found anywhere.

Fig. 50.

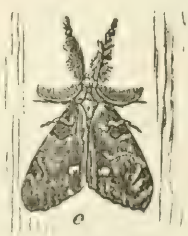

Fig. 51.
The male Tussock Moth.

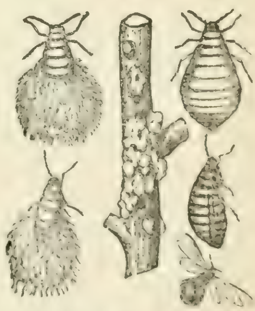

Fig. 52.
The Woolly plant-louse of the apple (*Schizoneura lanigera*).

Orgyia leucostigma, the tussock moth (Fig. 51), is evidently on the increase in Canada, from observation made here by myself. It seems that each year it is rather more plentiful. *Orgyia antiqua*.—This insect appeared in numbers this fall. I bred several females and whilst they were confined in the cage the air for yards around was literally full of the attendant males.

It was reported to me in the month of July that a great number of the maple trees in this town were apparently dying. As Orillia is one grove of these trees, the appearance of a pest was viewed by many of the inhabitants with great alarm. I examined a good many trees. I supposed at first that the borers *Clytus speciosus* or *Tremex Columba*, were the cause, but I could only account for the flagging energies of some of the limbs from the fact that nearly all the trees showing distress were largely covered in places with a woolly louse (*Schizoneura*), Fig. 52, which very much resembled the alder louse. I was not certain of the species, but I recommended kerosene emulsion, which I believe finished them, as the complaint ceased.

To a person who has always been imbued with a love of nature, to whom the war of the elements, the peaceful starlight night, the songs of the birds, the growth of a plant, the chirp of a cricket, the song of the Cicada, or the sight of an insect, alike send a thrill of pleasure through his mind and bring back a flood of pleasant recollections, I say to that person who has learned to love these things, it is almost impossible to understand how it is that so few people seem to obtain any pleasure from studying nature. To many there is no enjoyment but in business, and there are others who are always complaining that they do not know what to do to kill time. Just fancy this with the book of nature open before them and half, yes, nine-tenths, of its wonders unknown To those in business who have very little time to spare (I myself am one of these), I would say that no more pleasant relaxation can be found, when once the science of entomology, botany, or their kindred sciences, is known sufficiently to interest one to further pursue it. I am satisfied that if the study of these things was brought before the young in the proper way, it would make the youth of this country more manly, more diligent in business, more cultured and gentlemanly, and that the crime records would decrease correspondingly. This may seem a rash statement, but I claim that any one who has learned to study and love the works of nature will seldom do a deed of violence, when in tender years an occupation is found with all the elements of amusement, free from the taint of vice. The famous Dr. Johnson once said, when he heard of a man committing suicide: "He would never have done so if he had known how to hem a pocket handkerchief," implying that the want of an occupation induced the crime. And so likewise the study of entomology would keep the minds of those who take to it in pleasant occupation, which would increase, instead of failing as most other amusements do, as one by one the truths of nature were revealed; and I have every reason to believe that the interest would increase until the senses are benumbed with age, and this can be said of few earthly pleasures. The lack of interest is surely in the want of the first elements of knowledge of these sciences; but I trust that now entomology, from an economic point of view, is being studied, and the farmers and fruit growers of this country are awakening to the fact that to hold their own with their neighbors who have studied entomology, they must do so too —that ultimately the young will be taught it and the sciences of entomology and botany will form part of the curriculum of our public schools.

THE SAN JOSÉ SCALE.

(*Aspidiotus perniciosus*, Comstock.)

By James Fletcher, Dominion Entomologist, Ottawa.

In our annual report for 1894 there appeared a short article upon the San José scale. As there stated, the unexpected discovery in the Eastern United States and British Columbia of this scourge of the Pacific coast orchards made it all important to draw the attention of Ontario fruit growers to the subject, so that they might become familiar with the appearance of the insect and be prepared to promptly adopt active measures to eradicate it should it, as was thought more than probable, appear in our province. During the same year a further article was also published in the *Farmers' Advocate*, urging fruit growers to be on their guard against the introduction of the San José scale with nursery stock.

Since that article was written it has been seen how well founded were the fears that this dreaded enemy might spread to Canada and be a cause of loss in our fertile fruit districts.

The San José scale, it is thought, was introduced into California about 1870; but it was not noticed as a serious enemy until 1873, when it was discovered to be in great numbers on fruit trees at San José, Cal., a fact which has given to the insect its popular name. Its original home is not certainly known, but Japan is suspected.

As far as can be learnt, it had not been scientifically described until 1880, when Prof. Comstock treated of it in his annual report as Entomologist to the United States Department of Agriculture. Dr. L. O. Howard tells us that Prof. Comstock designated it by the specific name *perniciosus* because he considered it the most pernicious scale insect known in the country. "It swarmed in countless numbers upon the trees in certain orchards, and infested all the deciduous fruits grown in California except the apricot and the Black Tartarian cherry. In the course of twelve years the insect spread through all the fruit growing regions of California, through Oregon and into the State of Washington. It is known as the worst insect pest of deciduous trees on the Pacific coast and has caused great pecuniary loss. Many crops of fruit have been ruined and thousands of trees have been killed."

The above was written by Dr. Howard in April, 1893, since which time a great deal more than was then known has been learnt concerning this insect and its capabilities as an enemy to the fruit grower. It has been introduced into the east and, contrary to expectations, has shown that the climate of the Eastern United States is sufficiently well suited to its requirements for it to have developed so rapidly and with such deadly effects upon the trees infested that it has now become of national importance. It is at the present time acknowledged to be by far the most serious insect enemy of fruit trees which has ever been studied by practical entomologists. Owing to its very inconspicuous appearance and to the fact that it passes the winter attached firmly to the bark of fruit trees, it has been distributed widely and unwittingly by nurserymen with young fruit trees and now occurs in almost every State of the Union. It has also spread up into Canada, where it has been found on two or three occasions in British Columbia and has also established itself at a few places in the peach districts of Ontario. The first specimens of this insect received from an Ontario orchard were from the vicinity of Chatham in Kent county. This was in January, 1897. Very soon afterwards it was discovered that there were other orchards near Niagara and St. Catharines which had been similarly infested through fruit trees imported from the United States The last discovered occurrence of this insect was made quite recently near Kingsville in Essex county, where three centres of infestation were found on one fruit farm, involving upwards of 300 trees. The above are all the authentic instances of the occurrence of the San José scale in Ontario which I have been able to learn of, although at various times during the summer several reports of infested orchards have been received. Upon investigation, however, these have proved to be occurrences of some other scale insect. In addition to several kinds of scale insects which were sent in for identification under the supposition that they were the San José scale, many other insects in no way resembling a scale insect were sent. From the many kinds of these belonging to various orders, it seems advisable to state that the San José scale is not an easily seen insect, resembling a beetle, a fly or a spider, nor has it well developed wings and legs, but it is a minute creature which can be detected only by the closest search and even then requires some skill and experience to recognize it as an insect. Among the objects which have been enquired about were many things quite unlike scale insects, but there were others which certainly do present very much the same appearance. Among these were certain minute fungi found on dead wood, and particularly the small corky excrescences known as lenticels which occur upon the young bark of many trees, as the apple, pear, birch, black walnut, etc. Their different nature may, however, be generally ascertained easily by the fact that they cannot be removed from the bark without tearing the tissues, while scale insects may be easily moved by gentle pressure as with the finger nail.

In view of the almost unanimous demand by fruit growers for protective legislation against this enemy, it became of much moment to find out as soon as possible what was the true state of affairs in the province with regard to its actual distribution and establishment in our orchards.

On June 10th a well attended meeting of fruit growers was convened at the orchard of Mr. Charles Thonger, near Niagara, when the subject was discussed at length. The necessity for everyone concerned being able to recognize the scale was brought out at this meeting and steps were immediately taken to supply an evident lack of knowledge on this point among Canadian fruit growers. Prof. J. Hoyes Panton, of the Government Agricultural College, at Guelph, prepared and issued promptly an excellent concise bulletin, which was widely distributed by the Hon. Minister of Agriculture and Arts, and at the same time a large illustrated wall poster, 2ft. 3in. by 1ft. 8in., was prepared by the Dominion Entomologist at Ottawa for putting up in Post Offices, Railway Stations, School Houses, Public Halls and other much frequented places. This was illustrated with figures of an infested pear and a piece of an infested branch, natural size, and also enlarged figures of the female insect and her scale. Warning was given that the San José scale was already in Canada and that if it were allowed to spread, great loss would surely be the result. The best way to identify the insect was given, together with advice as to the proper remedy and the way to apply it in case anyone should be unfortunate enough to find this public enemy on his trees.

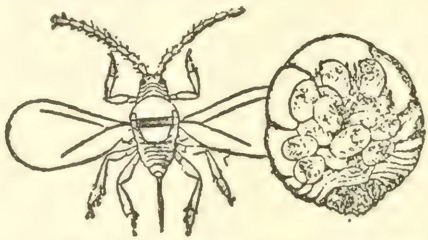

Fig. 53. Female scale, with a male adult to the left, greatly enlarged.

These sources of information were distributed widely amongst fruit growers living in those districts where the San José scale was likely to occur. In addition to the above measures, by instruction of the Hon. John Dryden, special attention was paid to this subject by Mr. W. M. Orr, the Superintendent of Spraying Experiments, and every effort was made to find out to what extent orchards were infested. Whenever the scale was found, active measures were at once put in force to secure its eradication. Collections were made of the scale upon various fruit trees and show cases were exhibited in the more important autumn exhibitions, which were attended by Mr. Orr, who was untiring in his efforts to explain to visitors the nature of the insect and warn all against neglecting it. In every instance where this pernicious insect has been found on trees in Canada the owners have done their utmost to destroy it, sparing no expense of labor or material. All were easily convinced by the fatal effects of its presence on their trees that this was no ordinary insect pest they had to fight against.

What is the San Jose' Scale? The San José scale is a very small (about one-tenth of an inch in diameter), round, flattened and inconspicuous scale insect, that is, a sucking insect like the well-known Oyster-shell Bark-louse and the Scurfy Bark-louse, covered by a waxy scale which, as we find it on trees, is the only part visible except in the early larval stage, when scale insects, for a few days, have the power of walking.

The exact identification of this species is a matter of some little difficulty, for there are at least two other scales occurring on fruit trees in Canadian orchards, the Putnam Scale *(A. ancylus*, Put.*)*, and the Forbes Scale *(A. Forbesi*, Jnsn*)*, which superficially so closely resemble the San José scale as to render it necessary for a specialist who has studied the matter before hand, to examine the mature females under the microscope and that after boiling in caustic potash, before the difference can be made out. Moreover, both of these scales occasionally may be found in vast numbers upon an infested tree, but the exac

identification is, nevertheless, a matter of great importance because it has been found by experience that neither of these scales causes very serious injury to fruit trees as compared with the San José scale. This is chiefly due to the fact that they seldom spread from tree to tree with anything like the rapidity of the last named species. Indeed, the occurrence in very large numbers of a scale insect upon a tree cannot always be taken as conclusive evidence that the species is a dangerous one, for it has frequently been noticed that scale insects may be present in enormons numbers upon a special tree, even killing it, and yet not be found at all upon trees of the same sort growing close by. In the case of the San José scale, on the other hand, if other trees are reasonably near, it is almost certain that they will soon become infested, and when a severe case of infestation is found, one of the first things looked for when considering whether the pest is actually the San José scale or one of some other species which superficially resembles it closely, is to notice whether the surrounding trees are infested also.

This important difference of habit in spreading and the much more fatal effects upon the trees from the presence of the San José scale, make much more stringent measure necessary to secure its eradication than with many other species, even frequently rendering it advisable, or imperative, to destroy many trees, or even whole orchards. This being the case, the very great advantage is obvious of being perfectly sure as to the identity of an infesting scale insect before valuable trees are condemned to destruction.

A. B.

Fig 54. Appearance of scale on bark; *a*, infested twig—natural size; *b*, bark as it appears under hand lens, showing scales in various stages of development and young larvæ.

The following description of the San José scale and its life history are taken from the annual report of the Entomologist and Botanist of the Dominion Experimental Farms for 1897:

How to know it.—The general appearance of the bark of infested trees is dirty, scurfy and grayish in color, as though dusted with ashes. The scales usually are found in enormous numbers, frequently overlapping or occurring altogether on the top of older scales; they may be found throughout the summer of all sizes, from the newly

hatched mite-like larvæ to the full-grown insects. In severe cases of infestation this massing of the scales produces a scurfy appearance of the bark, which when once seen is easily recognized. On young twigs and fruit and leaves, there is usually a well defined purplish ring surrounding each scale, and although this purpling effect is produced by a few other scales, such as the Putnam scale (*A. ancylus*, Put.), it is particularly characteristic of the San José scale, and even upon large branches, although invisible at the surface, may be found by cutting away some of the bark.

The scales of the males and females differ somewhat in shape.

Female:—Scale very thin, almost circular in outline, much flattened; size ranging from one-twentieth to one-eighth of an inch in diameter white at first, becoming grayish or blackish, and later much blackened by the fungus *Fumago salicina*, so common on trees attacked by many kinds of bark-lice and plant lice. In the centre of the scale is a small dark or yellowish nipple-like elevation surrounded by a distinct circular darkened depression, which, as pointed out by Prof. Webster, is one of the best distinguishing marks between this scale and some closely allied species.

Male:—Scale about half the size of that of the female, rounded-oblong, with the nipple-like elevation nearer one end than the middle.

Life History.—The winter is passed by the partially grown insects beneath their scales. With the return of warm weather next spring growth is resumed, and the males reach maturity a few days before the females. They are extremely small two-winged flies, and when examined under a magnifying glass are found to have orange-yellow bodies, iridescent dusky wings and black eyes. The minute creatures have no mouths,

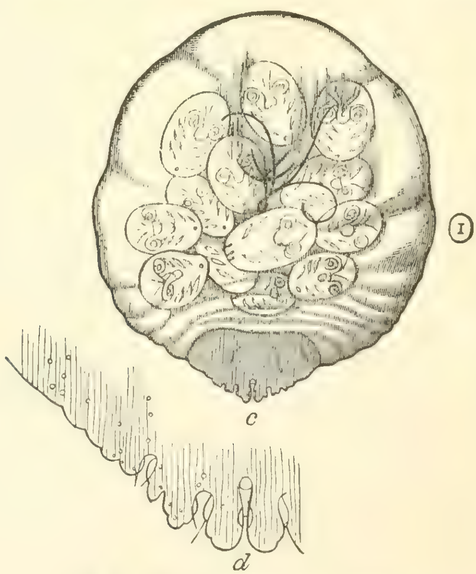

Fig. 55. Female scale much enlarged.

so can take no food; consequently, having fertilized the females, they very soon die. The date when the females become full grown and begin to produce young varies, of course, with localities and climate. In Arizona the young larvæ are recorded as appearing in March. At Washington it is by the middle of May; in the State of New York, early in June; at Amherst, Mass., they were first noticed 12th June; and, as far as I can learn, between the middle of June and 1st July in our Niagara district. Most careful observations have been made under direction of the U. S. Entomologist, by Mr. Theo. Pergande. The following condensed life history is compiled chiefly from U. S. Div. of Entom. Bul. No. 3, N.S., in which Mr. Pergande's observations are recorded.

The adult female gives birth to living young, differing in this respect from most other scale insects. Ordinary, as with the Oyster-shell Bark-louse, eggs are laid beneath the scale, which in the course of a longer or shorter time hatch and the young larvæ migrate to different parts of the plant; but in the case of the San José scale young are produced day and night for a period of nearly six weeks before the exhausted female perishes, and this at the rate of about nine or ten every twenty-four hours.

After birth the young larva remains motionless for a short time beneath the scale of the mother, it then forces its way out and runs over the plant, seeking a suitable place to settle. It is a microscopic creature, pale orange in color with an oval body, six legs and two feelers. The long, thread-like proboscis with which it sucks the sap of the plant, is doubled on itself and lies in a groove of the body wall After crawling about for a few hours, the larva settles down and works its bristle-like sucking tube through the bark and remains fixed, if it be a female, for life; and if a male, until fully developed, when it will have a few hours more, during which it can fly about.

The development of the scale begins even before the larva becomes fixed. The secretion starts in the form of very minute, white, waxy filaments, which spring from all parts of the body and rapidly become more numerous until within two days the insect is entirely concealed by a whitish shell or scale, which now has a prominent central nipple. The scale is formed by the matting and melting together of the waxy filaments. As in the development of most insects, there are distinct periods of the larval life, divided by moults of the skin, and in the case of the male scale insects marked by important structural changes. The first moult takes place when the larva is twelve days old. Up to this time the male and female scales are exactly similar in size, color and shape, but after the moult the insects beneath the scales bear no resemblance to each other. The males are rather larger than the females and have large, purple eyes, while the females have lost their eyes entirely. The legs and feelers have disappeared in both sexes. Eighteen days after birth the second moult occurs and the males change to the first pupal condition (pro-pupa) the small scales now assume an elongated shape. the legs and feelers have re-appeared and there are now two prominent wing pads extending along the sides of the body. About twenty days after birth the male insect changes to the true pupa, in which all the parts shown in the pro-pupa are more developed and a slender organ at the end of the body, called the style, has appeared. From four to six days later, or from twenty four to twenty-six days after birth, the males mature and back out from the rear end of their scales. This is chiefly by night or in the evening.

The changes which have gone on beneath the female scales are less striking than those described above. After the first moult, the body of the female is practically an almost circular flattened sac, with indistinct segmentation and without organs, except the long sucking bristle with which it sucks up continuously the sap of the tree it is infesting. The female moults a second time about twenty days after birth and the last segment now shows the important characters of the mature female which are of so much service in the exact identification of the species. The segmentation of the body at this stage is quite distinct.

Thirty days from birth the females are full grown and the embryonic young may be seen within their bodies. The mature female, prior to the development of the young, is 1/30 of an inch wide and 1/25 of an inch long.

The length of time necessary for the development of a generation varies somewhat, and according to the Washington observations covers a period from thirty-three to forty days from the time the young larva appears until it develops into a mature female, bearing young. The San José scale is enormously prolific. It has been calculated that a single female may be the progenitor of 3,216 million descendants in a single season.

A most serious Enemy.—It cannot be too often repeated that the San José scale is one of the very worst enemies that the fruit grower has ever had to deal with. Its inconspicuousness and presence upon trees in a dormant condition at the time when these or scions from them are distributed, render it liable to be overlooked. Its great

power of increase when introduced into a new locality and the fatal effects of its attacks on trees, as well as the extensive range of food plants it will attack, which includes nearly every deciduous tree and shrub, added to the difficulty of treating it effectively, all combine to make this insect what it is acknowledged by most to be, as stated above, one of the worst insect enemies we have ever had to contend with.

Notwithstanding this, there is always a tendency among those who are not well informed, to minimize the danger and neglect the necessary precautions. On this point it may be well to give the following short quotations from two of the leading economic entomologists of the United States:

Prof. Webster, of Ohio, says in his official report to the Ohio State Horticultural Society: "The statement has been made that 'the scale is not a particle more destructive than many of our native species of injurious insects or than those to which we have become used;' but anyone who is at all familiar with this pest understands that this is not at all the case, and that we have no other insect that is so deadly in its effects or so difficult to detect until it has become fully established, and certainly we have nothing in Ohio which, if it gets on to a tree, is as sure death. Besides, such talk as this only makes the enforcing of remedial or protective measures more difficult."

Fig. 56. San Jose Scale. *a*, pear moderately infested; *b*, female scale enlarged.

Dr. J. B. Smith, speaking before the Moorestown (N. J.) Farmers' Institute in December, 1897, says: "The San José scale is without doubt the most important of the fruit pests with which the fruit growers of this section must deal. I say 'must deal' advisedly, because developments during the latter part of last summer and even since then have made it certain that the San José scale is so firmly established in our State that its extermination can no longer be considered a possibility."

After treating of the extent of the infestation in the State of New Jersey, Dr. Smith says: "The scale must be dealt with, or you must abandon fruit culture. It can be dealt with if intelligent effort is made. The treatment is not easy and at first is expensive. It is for the fruit grower to decide whether his orchards are worth it. If not, he had better destroy them at once and plant something else."

REMEDIES.

Cutting down.—When a tree is found to be heavily infested with the San José scale, the cheapest plan will generally be to cut it down at once and burn it, for it is probable that a tree which has once been badly attacked will never recover its full vigor, even although every scale is killed.

Whale-oil Soap.—If, however, a tree is only slightly infested or there are special reasons for trying to save it, it should be pruned back as closely as it will stand and then washed thoroughly two or three times with whale-oil soap (two pounds of soap to one gallon of water). This is an expensive treatment, but, on the whole, it is the most effective yet discovered.

Kerosene Emulsion.—A treatment which has given equally good results, but a little more trouble on account of the extra labor, is to spray the trees as soon as the leaves fall in the autumn with kerosene emulsion (Riley-Hubbard formula diluted with four or five times its volume of water, and then before the buds expand in the spring apply the two pounds to one gallon whale-oil soap wash.

Dr. Howard found after many experiments that what is required for spraying purposes is a caustic potash and fish oil soap which does not contain over twenty-five or thirty per cent. of water. Mr. Marlatt of the United States Division of Entomology, states that a new brand of soap known as Good's Caustic Potash Whale-oil Soap No. 3 is one of the best which has been put on the market.

Pure Coal Oil.—A great deal of attention has lately been drawn to the treatment of trees with pure kerosene or coal oil to free them from the San José scale. This matter was first brought forward publicly by Prof. Webster three years ago, and pure coal oil had also been used with success previous to that in 1893, by advice of Dr. J. A. Lintner, upon the trunks of peach trees infested with the Peach Bark-borer (*Phlœotribus liminaris*, Harris). (Cent. Exp. Farm Report, 1893, p. 216.)

Prof. J. B. Smith, of New Jersey, has experimented extensively with kerosene and claims that, when the work is done carefully and as he advises, the scale insects are killed by this treatment better and more cheaply than by any others, and without injury to the trees.

My own experiments with coal oil have been too limited and irregular in results to justify me in recommending this method, and Prof. Webster, when reporting upon his experiments says: " I own that for a time I hoped it was possible to use coal oil in destroying the scale without injury to the trees; but our experiments up to date indicate that except on the apple and some of the more hardy of the other fruits, and in cold weather, it is exceedingly dangerous to attempt its use; and, until we have had time to make further investigations, I wish to warn against its use otherwise than as above indicated." On the other hand, Prof. Smith and Mr. C. L. Marlatt have found that trees can be sprayed even in summer when in full leaf with pure kerosene and no injury result to the plant. Prof. Smith's instructions are as follows: " Spraying should be done with the finest Vermorel nozzle and with force enough behind it to send out an absolutely mist-like spray. Cover fully, but no more, that there may be no running down or lodging in forks or getting around the trunk down to the roots. The whole aim should be to put on the thinnest complete film possible. Spraying should be done on a clear, dry day, that evaporation of the kerosene may not be interfered with. The oil acts at once on the insect, and as soon as its work is done, we want to get rid of it as fast as possible. The trees should be dry when sprayed. If they are wet the oil will not penetrate, but remain as a film over the moisture until it disappears."

The details of the above treatment are given here because there has been so much inquiry about it by Canadian fruit growers who have seen Prof. Smith's recommendation, and it is doubtless advisable for those having infested trees to experiment upon a few of them and if good results are obtained many valuable trees may be saved.

Gas Treatment.—For thorough work in treating infested trees, the fumigation with hydrocyanic acid gas seems in California to have given the best satisfaction. This

method, however, is expensive and the materials used are intensely poisonous However, for large nurseries where many young trees have to be disinfected before being sent out, this is stated to be the best method and is very generally adopted by the large American nurseries.

The plants are placed under a canvas tent made air tight by painting it twice with linseed oil. The first coat must be quite dry before the second is applied. The size of the tent is immaterial, but must cover the trees entirely, and the edges of the tent should be long enough to lie on the ground so that the tent may be perfectly air-tight by having earth thrown upon the lower edge to prevent the gas from escaping. The latest formula for generating the gas is as follows :

Cyanide of potassium (98 per cent)	1 ounce
Sulphuric acid (66°)	1 ounce
Water	2 ounces

for every hundred feet of space to be fumigated. Put the acid and water in an earthenware vessel large enough to prevent spattering, then place the jar under the tent and add to it the cyanide of potassium and close the opening quickly. The trees should be treated for at least forty-five minutes, when it will be found that insects of all kinds have been destroyed.

For the treatment of nursery stock prior to shipment large air-tight chambers or boxes are made in which the trees are placed.

Warning.—There is at the present time a great demand on the part of fruit growers for protective legislation both from the Provincial and Dominion Governments, and it is possible that something may be done in this direction ; but, in the mean time, I would urge upon fruit growers and every one else to protect themselves and the country at large by putting into practice what after all are only ordinary common-sense measures of precaution. Foremost among these are certainly the exercising of the greatest care possible in buying nursery stock. As far as we have been able to learn, none of our Canadian nurseries are yet infested. Therefore, stock purchased at these nurseries, if grown in Canada, must be much safer than any that can be imported from nurseries in the United States which are known to be infested. Owing to the difficulty of detecting the scale on trees when it only occurs in small numbers, and to the fact that it infests almost every kind of plant likely to be imported, I do not consider it safe to accept for this insect the guarantees sometimes given by nurserymen that stock is free from infestation. It will be far better for Canadian growers to do without imported trees altogether, for a year at any rate, until we see the effects of the wise and active measures towards the eradication of this pest which are now being taken by the Department of Agriculture and Arts of Ontario, rather than by purchasing from United States nurseries to run the risk, however slight that may be, of bringing in more infested stock. Every effort is being made to discover and wipe out all cases of infestation, and I feel confident that, if energetic measures are adopted now, even the San José scale, as it now occurs in Canada, can be controlled.

NINTH ANNUAL MEETING OF THE ASSOCIATION OF ECONOMIC ENTOMOLOGISTS, DETROIT, MICH., AUG. 12-13, 1897.

The Association met in room 212, Central High School building, immediately following the adjournment of Section F. Thirteen active members were present, together with many visitors, prominent among the latter being Dr. C A. Dohrn, Prof. E. B Poulton, Dr. C. P. Hart, Dr. C. S. Minot, and Dr. C. W. Stiles The Association was called to order by the President, and in the absence of Secretary Marlatt, Mr. A. H. Kirkland was

chosen secretary *pro tem.* The address of the retiring president, Prof. F. M. Webster, treated of "The Present and Future of Applied Economic Entomology in the United States," and contained, among other very interesting features, an admirable tribute to the value of the systematist and a somewhat caustic criticism of the "species maker," helpful suggestions for the Experiment Station worker, and a very frank discussion of the unfortunate results which attend the attempts sometimes made to combine politics and science.

The following were elected to active membership :

A. T. Britton, New Haven, Con.

G. B. King, Lawrence, Mass.

Gerald McCarthy, Raleigh, N.C.

E. P. Felt, Albany, N.Y.

A. F. Burgess, Malden, Mass.

W. B. Barrows, Agricultural College, Mich.

R. H. Pettit, " " "

W. S. Blatchley, Indianapolis, Ind.

The following were elected foreign members :

Claude Fuller, Richard Helm, both of Perth, West Australia, and W. W. Froggatt, Sydney, New South Wales. These additions increase the numbers of this Association to 93 active and 31 foreign members.

Prefacing his remarks with a brief review of the damage by the larvæ of *Orgyia leucostigma* in Washington during the summer of 1895, and the important influence of parasites in controlling this outbreak, Mr. Howard presented the following papers :

ADDITIONAL OBSERVATIONS ON THE PARASITES OF ORGYIA LEUCOSTIGMA.

In Bulletin No. 5, Technical Series, Division of Entomology, United States Department of Agriculture, entitled "A study in Insect Parasitism," it was shown that following an extensive attack by *Orgyia leucostigma* upon the shade trees of Washington, which culminated in August, 1895, there was an extraordinary development of parasites. Thirty-five true parasites were reared, of which fifteen were primary hymenopterous parasites and six primary dipterous parasites, fourteen species being hymenopterous hyper-parasites. In the autumn of 1895 about 90 per cent. of the caterpillars were destroyed by primary parasites, the vast majority of these being hymenopterous and the bulk of the work being done by *Pimpla inquisitor* and *Chalcis ovata.* In the spring of 1896 so many of these primary parasites had successfully hibernated that they were in position to almost annihilate the first brood of caterpillars, already weakened greatly in numbers by the extensive parasitism of the previous autumn. In the later months of 1896, however, an extensive hyper-parasitism began to be effective, and the principal primary parasite, *Pimpla inquisitor*, was almost killed off by its own hymenopterous parasites and principally by *Dibrachys boucheanus.* Tertiary parasitism was noticed at this time, but was not especially effective, and the Orgyia had begun to recuperate in numbers at the close of 1896. Several careful accounts in July, 1896, showed the percentage of parasitism to be 98.8 per cent., and the numerical details of the parasites concerned were found in one instance to be as follows :

On June 30 and July 8, 1896, 624 cocoons of the tussock moth were collected

without discrimination from the trunks of trees in the United States Department of Agriculture park. From these 624 cocoons issued the following parasites :

	Specimens.
Pimpla inquisitor	729
Bathythrix pimplæ	13
Limneria valida	1
Theronia fulvescens	1
Chalcis ovata	69
Dibrachys boucheanus	50
Asecodes albitarsis	1
Frontina aletiæ	7
Frontina Frenchii	14
Tachina mella	12
Euphorocera claripennis	15
Exorista griseomicans	4
Total	916

The part played by dipterous parasites up to the winter of 1896, when the bulletin in question was published, had not been great, only 187 specimens in all having been reared. All the species were well-known Tachina flies of wide distribution and general parasitism.

A recuperation in numbers of the Orgyia was quite marked in the spring of 1897, and additional and heretofore unreported observations were made. So great had been the destruction of *Pimpla inquisitor* that in these observations this species did not appear in a single instance! Another hymenopterous parasite, *Chalcis ovata*, became prominent, and it is worthy of note that while secondary parasites of this species are strongly suspected, it is not absolutely known to have any. A striking feature, however, was the great increase in the number of the dipterous parasites. The rearings were conducted on a large scale, and the following table affords an interesting comparison to the one just given.

Five thousand larvæ and pupæ of *Orgyia leucostigma* were collected July 6 to 9, 1897. From these there had issued up to August 2 the following parasites :

	Specimens.
Tachina mella	220
Frontina Frenchii	355
Euphorocera claripennis	464
Exorista sp	13
Helicobia helicis	4
Phorocera sp	45
Chalcis ovata	551
Apanteles parorgyiæ	3
Dibrachys boucheanus	10
Total	1,665

Of these it will be noticed that more than two-thirds (1,101) were dipterous, while the previous summer dipterous parasites had constituted only about one-twentieth of the number reared.

From the 5,000 cocoons there issued also 321 male moths and 764 female moths; 146 of the caterpillars or chrysalids died from a disease which we have for convenience called "black rot," and 33 from another disease which for the same reason we have called "red rot."

In percentages the result may be expressed as follows :

	Per cent.
Moths	21.07
Dipterous parasites	22.02
Hymenopterous parasites	11.02
Disease	3.58
Total	57.69

This leaves about 2,000 chrysalids dead from causes not yet ascertained. From careful examination of a small proportion of them it seems probable that from 400 to 500 have been killed by parasites which have died without emerging. There still remain also about 200 dipterous puparia in the rearing cages, from which the adults may still emerge. That the majority of the remainder have died from disease seems probable. The mortality ratio was, therefore, 79 per cent., as against 98.2 per cent. at a corresponding time last year ; and, while last year hymenopterous parasites were responsible for nearly the whole of the mortality, this year they brought about not more than 15 per cent.

These additional observations only accentuate the extraordinary features of the parasitism of this lepidopterous insect. The multiplicity of factors upon which its increase and decrease depend and the important interrelations of the species concerned are astonishing to one who has not especially studied this phase of insect life.

TEMPERATURE EXPERIMENTS AS AFFECTING RECEIVED IDEAS ON THE HIBERNATION OF INJURIOUS INSECTS.

It is a well-known fact among agriculturists and horticulturists that winter weather of a steady degree of severity is more favorable to plant growth than an open winter with alternating freezes and thaws. With regard to certain injurious insects it has become an accepted idea among economic entomologists that this same principle will hold, yet the question comes to all of us from farmers and others with a considerable degree of frequency as to whether a given winter which has been unusually severe will not have resulted in the destruction of injurious insects to such an extent as to promise comparative immunity the coming season. We have been obliged, or at least the writer has been obliged, to answer such questions theoretically. There has been no exact experimentation, so far as he is aware, along this line. It is, therefore, with pleasure that he calls attention to the results of recent experimentation by Dr. Albert M. Read, of Washington, the manager of the cold storage department of the American Security and Trust Company, and the same gentleman who conducted the experiments on the effect of cold storage upon household insects referred to in a paper read by the writer before the last meeting of this association. Dr. Read has found in the course of his experiments, which have now extended over two years, that a constant temperature in the neighborhood of 18° F. will not destroy the larvæ of *Tineola biselliella* or of *Attagenus piceus*, but that an alternation of a low temperature with a comparatively high one invariably results in the death of the larvæ of these two insects. For example, if larvæ of either which have been kept at a temperature of 18° F. are removed to a temperature of from 40° to 50° F. they will become slightly active, and when returned to the lower temperature and kept there for a little time will not revive upon a transfer to the warmer temperature.

It is thus rather satisfactory to have experimental proof in support of previously accepted but more or less theoretical ideas.

Mr. Rolfs had noticed that after severe frosts and cold in Florida there was an abundance of northern insects, especially Orthoptera.

Mr. Craig described the severity of the winter of 1896-97 in Canada, when there was severe cold but little snow. This year, throughout southern Canada, plant-lice were present in tremendous numbers on apple, plum, cherry, and other trees.

In the general discussion which followed, the fact was brought out that plant-lice had been particularly abundant throughout Canada and the United States during the past summer.

Mr. Howard pointed out the fact that this abundance was probably due to the wet weather of late spring and early summer, which had checked the feeding and multiplication of the natural enemies of the plant-lice.

Mr. Minot stated that in the vicinity of Milton, Mass., injurious insects had been quite scarce during the past summer; fewer potato beetles had been noticed than for many years, while rose-chafers and tent-caterpillars were equally scarce. He also had noticed the great abundance of plant-lice early in the season, but after the extreme hot weather of the first week of July their numbers greatly diminished.

Mr. Howard emphasized the fact that hot weather played a very important part in controlling plant-lice. He cited an instance where, several years ago, Mr. Barrows had called his attention to the extraordinarily large number of plant-lice upon certain shade trees of Washington, D.C. The following day the temperature reached the maximum of 100° F., and as a result the plant-lice disappeared like magic.

Mr. Ashmead called attention to the fact that the family of plant-lice was not extensive in the tropics, thus supporting the theory previously discussed.

Mr. Barrows stated that the condition in Michigan regarding plant-lice was probably the same as that in Canada. He was of the opinion that the great abundance of these insects in Michigan during the past summer was probably due to the large number present last year. While examining the orchards for the San José scale last winter his attention was attracted by the remarkable quantities of plant-lice eggs deposited on young nursery stock and on orchard trees. So numerous were these eggs in some cases that the trees had the appearance of being varnished. His experience agreed with that of Dr. Howard, that hot weather was a most important factor in controlling the increase of plant-lice. Referring to Mr. Howard's first paper, Mr. Barrows spoke of the general lack of appreciation of the value of such experiments as those described and the lack of careful observations concerning the relation of temperature effects to the increase or decrease of injurious insects in connection with the abundance or absence of their natural enemies. A man might have observed a decrease or increase over the normal of the temperature for the winter of 1895-96 and arrived at the conclusion that this had been the chief factor in checking the outbreak of the Orgyia caterpillar, thus neglecting to take into account the action of the parasites. There was great need for careful and exhaustive observations whenever temperature effects are associated with the abundance or scarcity of any insect.

Mr. Webster called attention to the fact that the great numbers of aphides in Ohio nurseries this year had seriously injured a large quantity of young, rapidly growing stock.

An abstract of "Notes on Certain Species of Coleoptera that Attack Useful Plants," by F. H. Chittenden, was read by the Secretary *pro tem.* These notes treated chiefly of the food plants and habits of certain Chrysomelids. "An Experience with Paris Green," by T. D. A. Cockerell, was also read by the acting Secretary.

A letter from Miss E. A. Ormerod called particular attention to the fact that the house sparrow had been very abundant and very obnoxious in certain parts of England, and it seemed probable that some legislation or public measures would need to be adopted to control this bird. The arrival from Tripoli of a cargo of wheat, badly infested by the Angoumois moth, was recorded and reference made to the occurrence in injurious numbers of *Xyleborus dispar* at Toddington.

Prof. P. H. Rolfs presented notes on "A Fungus Disease of the San José Scale." This disease seems to be confined to the southern part of the United States, but is very

helpful to fruit growers there. The scale has been almost eradicated from several orchards by means of it. Laboratory and field experiments now in progress promise hopeful results, but it does not seem probable that this disease will be of value in the northern part of the United States, since warmth and moisture are necessary for its development.

The next paper, treating of the same insect, was presented by Mr. Barrows :

THE PRESENT STATUS OF THE SAN JOSÉ SCALE IN MICHIGAN.

So far as we have any knowledge, the San José scale first came to the notice of the State Experiment Station May 14, 1896, when it was found on a single fruit tree in Jackson, and the tree was destroyed soon after. The origin of the affected tree was not ascertained, and as no other occurrences were reported from the vicinity it was supposed that no further trouble would result. In December following, however, it became evident from its invasion of the States adjoining Michigan on the south that our own State was in serious danger, and on application to the New Jersey nurserymen who were supposed to have sent out infested stock, a list of several hundred Michigan addresses was received by the horticulturist of the station, and a circular letter describing the scale and its work was sent to each address. Comparatively few replies to this letter were received, but among them were some which indicated the presence of the scale, and further enquiries showed its presence in several places.

During the winter many different parts of the State were visited in quest of the pest, but the severe weather, the lack of time, and especially the number and extent of the suspected orchards, made anything like thorough inspection impossible. The scale was located in greater or less abundance at half a dozen widely separated points, and this number has been increased by as many more through correspondence and the transmission of specimens. At present the scale is positively known to have existed in the ten counties, and in no case is there positive proof that it has been entirely eradicated.

In Ottawa County the infested stock was received from New Jersey in the spring of 1890, and thus had been established almost seven years before it came to the knowledge of any entomologist. During this time it had killed all or nearly all the trees on which it was brought, and had spread to all the other fruit trees in the immediate vicinity, some of which also had succumbed. Probably at this place several acres were badly infested, and of course it is to be feared that the scale has been carried to other orchards in the neighborhood.

In Ingham County one locality was found in the city of Lansing where the fruit trees about two houses and in their gardens were badly affected, and the scale had overrun rose bushes, currant bushes, grape vines, and even one or two shrubs of Spiræa. In this case the scale was originally brought on pear trees which were bought from a resident dealer in 1888 or 1889. The trees were said to have been obtained in New York State, but, as the dealer is known to have been unreliable, and as very few trees were true to name, it is not likely that any dependence can be placed on the statement. It is more than probable that the stock came from New Jersey, and that other parties in the vicinity have introduced the scale through the same dealer.

In still another case (and county) a dealer is known to have handled stock which was infested with the scale, and that at least five or six years ago, so that it is fair to assume that this pest is now pretty widely and thoroughly distributed through the fruit-growing parts of the State, and we may expect to find it in large quantities in all the counties of the four southern tiers, and yet farther north along the west side of the State. Since the scale thrives in Ingham and Ottawa counties it is likely to winter safely still farther north, and as yet the life zones in Michigan are so poorly defined that it is impossible to draw any line beyond which we may safely predict that the scale cannot live. * * * When we know more of the geographical distribution of life in Michigan, it may be possible to define with precision the limits beyond which the San José scale will

not become established, but at present we must consider the entire southern half of the Lower Peninsula as in danger of serious infestation, together with a strip of uncertain width bordering Lake Michigan at least as far north as Grand Traverse Bay.

It is too early yet to make any predictions as to the ultimate success or failure of attempts to limit by legislation the spread of the scale in Michgan. The last legislature passed a bill which takes effect late in the present month (August) requiring the inspection of all nursery stock offered for sale in the State, whether home grown or from outside, and compelling inspection and treatment of all suspected orchards or fruit trees wherever found. The bill as originally drawn was not, of course, altogether satisfactory, either to the nurserymen or the fruit growers, and during its passage through the legislature its strength was still further impaired by sundry concessions which seemed to be necessary in order to secure its adoption. It is hoped, however, that its provisions may be thoroughly enforced and its efficacy tested during the coming year, so that, if necessary, better measures may be provided by our next legislature.

In the discussion which followed these two papers, Mr. Craig stated that the condition in Canada relative to the San José scale was quite similar to that of Michigan. This insect had been found in British Columbia and in Ontario. In the latter Province there were seven well authenticated occurrences, these being probably in the upper austral region. Mr. Craig's investigations showed that the San José scale had been present in Canada for at least four years and came originally from two New Jersey nurseries, whose proprietors had kindly enabled him to trace the shipments of infested stock. Mr. Craig was of the opinion that the scale would do the greatest damage in the peach-growing region where, as early as July 1, 1897, he had found the young scales securely fixed on young, growing wood. Fungus cultures, received from Professor Rolfs, had been used in inoculation tests in the laboratory, but with no practical results as yet. It seemed probable that an endeavor would be made to obtain legislation with a view to preventing the shipment of infested nursery stock to Canada.

Mr. Howard inquired as to the known geographical distribution of the fungus disease. Mr. Rolfs said that, to the best of his knowledge, this disease was chiefly confined to the southern part of the United States. It had been found in Alabama, Georgia, South Carolina, and in one instance in Pennsylvania. It was most abundant at Auburn, Ala.

A paper from Prof. C. P. Gillette on "Insects taken at Light and Sugar," evoked considerable discussion, and was followed by "A Study of the Possible Origin and Distribution of the Chinch Bug," by Prof. F. M. Webster. The author advanced the idea that this insect had originated in the southern part of the United States and spread by two diverging streams up the Mississippi valley and along the eastern Atlantic coast. In the former region the long winged form predominated, while the coast form was short winged. In the discussion following this paper the general opinion seemed to be that the length of the wings depended upon environment rather than heredity. Mr. C. W. Mally recorded the capture at Ohio of a specimen having one long and one short wing, thus throwing additional light upon the relationship between the two forms.

"Notes on the Common House Fly," by Mr. Howard, gave the negative results of a series of experiments with lime, land plaster, etc., used to destroy the larvæ of the house fly. He emphasized the necessity of greater cleanliness in the management of horse stables

A paper from Mr. Gillette on "Vernacular Names of Insects," was read and referred to a committee consisting of Messrs. Howard, Fernald and Lintner. A communication from C. P. Lounsbury, giving very interesting notes on "Cape of Good Hope Insects," particularly the locusts of that region, was then read.

Mr. H. G. Hubbard presented an account of the "Insect Fauna of the Giant Cactus," recording the capture of a large number of insects on this plant and giving notes on their habits.

Mr. Howard described "A Valuable Coccid," lately discovered in Arizona and New Mexico, from which, by suitable treatment, a good grade of white wax could be obtained.

The refuse from this operation is of the nature and consistence of India rubber and may be of commercial value.

"Notes on Insects of the Year," by Messrs. Webster and Mally, recorded interesting experiences with several of the common insect pests. The negative results of a series of experiments with kainit, against the insects attacking the roots of the grape, caused considerable discussion, and the need for further experimentation along this line was pointed out.

A paper by A. H. Kirkland on "Preparation and Use of Arsenate of Lead," detailed a method of preparing this insecticide at a cost of about seven cents per pound. Work against the gypsy moth was mentioned, and the condition of the infested region was reported as generally better than that of last year. This undertaking, however, is still handicapped by insufficient financial support.

"A Malodorous Carabid," by Mr. Barrows, gave extensive notes on the annoyance and discomfort caused by the almost unbearable odour of this insect, *Nomius pygmæus.*

Among the papers read by title only, owing to the absence of their authors, but afterwards presented in the official report of the meeting, was a very valuable one by Mr. Marlatt, of the Division of Entomology, Washington, entitled "Notes on Insecticides," from which the following extracts are taken :

Soap as an Insecticide.

There is no more unsatisfactory substance to work with against insects than soap, for the reason, previously pointed out, of the extreme uncertainty of the composition and characteristics of any brand that is secured. The most earnest efforts on our part to get manufacturers to make a definite brand of soap which approached our ideal, and to keep the stock at a uniform and reliable strength and character, have been entirely unsuccessful, and we have not been able to get any two consecutive lots of soap having the same characteristics or value for insecticide purposes.

Pure Kerosene.

The discussion of this substance at the last meeting of the Association led to some additional experiments on our part with the use of pure coal oil or kerosene on plants. Various trees, including young and vigorous peach, pear, cherry and apple trees, euonymus bushes, and some old bearing peach trees, were thoroughly sprayed with pure kerosene early the past spring, with one exception, before the buds had begun to swell. In the case of two large bearing peach trees the blossom buds were swelling and opening and these trees were also badly infested with *Diaspis lanatus.* The other plants, with the exception of the euonymus bushes, were healthy and free from all insects Much to my surprise and astonishment, no ill effects of any moment resulted in the case of any of the trees sprayed with kerosene. In the case of all the trees spraying was continued just long enough to moisten the plants thoroughly, but not to cause the oil to run down the trunks and collect about the base, and with the young trees the soil was carefully mounded up and pressed about the crown to avoid all danger of the oil collecting at that point.

The pear trees treated, and also the peach, came out in full bloom, the opening of the blossom buds not being at all interfered with by the oil bath. After the bloom fell the peach trees treated with pure oil made much finer growth than untreated trees. This may have been in part due to the more favorable location of the trees, and possibly also to the fact that in the treatment with the coal oil the eggs of Aphides on the trees had been entirely killed, whereas on the untreated trees a very bad infestation with plant lice developed early and checked the growth of the trees, killing some of them. No Aphides, however, appeared on the sprayed trees. In the case of the pear trees particularly, and also the apple, the unfolding of the leaf buds was very noticeably delayed as compared with untreated plants, the buds seeming to open up much more slowly, and for two weeks at least the difference was very marked. Very soon thereafter, however,

the treated trees overtopped the others both in abundance of foliage and amount of new growth, and at the present writing, July 20, there seems to have been no injury whatever as a result of the treatment.

The large peach tree sprayed showed no ill effects, and all of the scales on the tree were killed except where they had been protected in a few instances by masses of leaves webbed about the limbs. At least 99 per cent. of the scales were killed. On the euonymous a similar result was shown, at least 99 per cent. of scales having also been killed by the oil.

These results are so greatly in contrast with those previously attained in the experiments conducted in practically the same way that it seems difficult to account for them. That spraying with pure oil will often kill trees can not be doubted, even when applied in the dormant condition in winter, as demonstrated by experiments on a number of apple and peach trees two or three seasons ago. It is possible that with these earlier experiments the same care was not employed to prevent the collection of oil about the trunks of the trees and the trees were not mounded up, but the work was as carefully done as would ordinarily be the case in actual practice, and probably much more so. It is possible, therefore, that the death of the trees in some instances was due to the collection of the oil in the cavity formed about the trunk by the swaying of the trees in the wind, which, as will be shown later, has had disastrous results in California with the emulsion even. Others have reported the use of oil on trees without injurious effects in some instances and in others with injurious effects, so that pure oil as an insecticide is one to be used with caution and with full appreciation of the fact that the death of the plant may result.

Use of Kerosene Emulsion in California.

This insecticide is used to a very considerable extent in California, much more so in recent years than formerly. It is the principal insecticide used in the district about San Diego, and is also used extensively at Santa Barbara and to a less extent elsewhere in the State. The necessity for the use of very large quantities of insecticides in California has led to the establishment by private parties in several instances of steam or gasoline plants for the wholesale production of this insecticide. Probably the first extensive manufacturing plant of this sort was set up by Mr. W. R. Gunnis, county horticultural commissioner, of San Diego, who manufactures the emulsion by the aid of a small engine, doing all the work of heating, churning, etc., by this means. With coal oil at 11 cents per gallon, he is able to produce the emulsion at a charge of 13 cents per gallon in the undiluted state, which makes the wash as applied to the trees, diuted 7 times, cost a little over $1\frac{1}{2}$ cents per gallon. In his district, Mr. Gunnis claims that the loss from scale insects has been reduced from 79 per cent. to 7 per cent., chiefly by the use of this wash.

At Santa Barbara the superintendent of the Las Fuentos ranch, Mr. Frank Kahles, has set up a very large plant for the manufacture of kerosene emulsion for the use of this ranch alone. The plant is similar to that devised by Mr. Gunnis, and the capacity is such that the emulsion can be made in quantities of 150 gallons at a time and very rapidly. He uses a formula slightly different from the Hubbard. The proportions are 35 gallons of whale-oil soap, 100 gallons of kerosene oil, and 50 gallons of water. This is diluted for application to trees with seven parts water, costing in the diluted state $1\frac{3}{8}$ cents per gallon.

Kerosene emulsion has probably been given its most extensive trial on the Pacific Coast at the Las Fuentos ranch. Two years since Mr. Gunnings sent his excellent spraying apparatus to Santa Barbara, together with some 8,000 or 10,000 gallons of emulsion, and thoroughly sprayed the lemon plantings, comprising upward of 25,000 trees.

In some of the earlier work many trees were killed, owing probably to the accumulation of oil in the bottom of the reservoir or tank, so that the last three or four trees with each filling received an unusually heavy dose, which, running down the trunk, col-

lected in the cavity about the crown caused by the swaying of the trees in the wind. The accumulation of oil in this way may be prevented by giving the tank a conical bottom, so that the liquid may be thoroughly exhausted each time before refilling, and as a further precaution, before treating, the trees may be mounded up about the base and the earth thoroughly compacted. With these precautions no injury has resulted from the later sprayings. The treatment kills the young of the black scale and the fungus breaks up and soon peels off.

Lime, Salt, and Sulphur Wash.

As the members of the Association are aware, this is the almost invariable remedy for the San José scale on the Pacific slope, and as a rule it is undoubtedly effective. Our experience with this wash in the East had thrown doubt on its real efficiency as an insecticide, and it has been clearly demonstrated that under the climatic conditions east of the Alleghanies it is almost valueless. In California, however, after a careful study of the facts in the field, I am compelled to admit that the demonstration of its usefulness against the San José scale is complete and the benefit of its application to orchards is most manifest. In the vicinity of Pomona, Cal., unsprayed orchards were badly infested with San José scale, while in adjoining sprayed orchards the scale was entirely killed and the trees were rapidly recovering and showing vigorous and healthy new growth. In contiguous orchards, also, of the same kinds of trees, similarly treated so far as cultivation is concerned, the trees which had been subjected to yearly spraying were at least one-third larger than untreated trees. This wash is of value also as a fungicide, protecting stone fruits from leaf fungi, and is also a protection against birds, the common California linnet doing great damage to buds in January and February. The wash is almost invariably made and applied by contractors, and costs about 5 cents per gallon applied to the trees. It is a winter application, being applied in January and February.

Along the coast region and in northern California, where moister conditions prevail, this wash is very much less successful, bearing out somewhat the experience of the East, and doubtless explained by the similarity of climate in the districts mentioned with that of the Atlantic seaboard In making this wash the chief consideration seems to be prolonged boiling. The wash itself is practically a sulphide of lime, with much free lime and salt carried with it. Prolonged boiling will result in taking up temporarily additional sulphur, and will perhaps add to its caustic properties if it is applied very hot; on cooling, however, it reverts to the simpler tri- or bi-sulphide of lime. The proportions of the ingredients and the method of combining them vary slightly in different sections. The following is the ordinary formula: Unslaked lime, 40 pounds; sulphur, 20 pounds; salt, 15 pounds; one-fourth of the lime is first slaked and boiled with the sulphur in 20 gallons of water for two or three hours; the remainder of the lime is slaked and together with the salt is added to the hot mixture and the whole boiled for half an hour or an hour longer. Water is then added to make 60 gallons of wash. This wash is applied practically every year, or as often as the San José scale manifests itself in any numbers. In the coast region and in the northern part of the State it is necessary to apply it with greater frequency than in the interior districts.

Arsenicals and Lime.

The advantage of the employment of lime with Paris green or London purple having been called in question at the previous meeting of this association, the matter was again made the subject of experimental test, and the old belief of the decided protective value to the foliage of the addition of lime was fully and strikingly demonstrated.

At the final adjournment of the session it was voted to hold the next meeting at Boston, Mass., Aug. 19th and 20th.

Several resolutions were passed, among which were (1) a resolution requesting the publication of the proceedings as a bulletin of the Division of Entomology, U. S. Dept. of Agriculture and (2) expressing familiarity with the efforts of the State of Massachusetts to exterminate the gypsy moth and commending the results already accomplished.

The election of officers resulted as follows:—President, Herbert Osborn, Ames, Iowa; 1st Vice-president, Lawrence Bruner, Lincoln, Neb.; 2nd Vice president, C. P. Gillette, Ft. Collins, Colo.; Secretary and Treasurer, C. L. Marlatt, Washington, D. C.

James Fletcher, LL.D., F.R.S.C, F.L.S.

We are happy to be able to prefix to our twenty-eighth Annual Report, an excellent portrait of Dr James Fletcher, whose name is a household word among Entomologists not only in Canada, but throughout North America, and in many parts of the world besides. Born and educated in England, Dr. Fletcher came to this country when a young man as a junior officer in the Bank of British North America, and soon began to devote his leisure hours to the study of insects and plants. Find the work of a bank by no means congenial to his literary and scientific tastes, he obtained a position as assistant in the Library of Parliament at Ottawa. It was not long before his talents and attainments in botany and entomology became widely known, chiefly through his contributions to the *Canadian Entomologist* and the Annual Reports of our Society. His first paper in the latter was an article on Canadian Buprestidæ, which was published in 1878, while his first contribution to the Magazine appeared in January 1880. During all the years that have followed no volume of either publication has been issued without some valuable articles from his pen.

In 1878 he became a member of the Council of the Entomological Society of Ontario and every year since has been elected to hold some office in the Society, being four times Vice-president and for three years, 1886-8, President. In 1879 he was one of the originators of the Ottawa Field Naturalists' Club, the most successful society of the kind in the Dominion, and more recently he suggested, and by his influence and energy, accomplished the formation of the important Association of Economic Entomologists of North America.

The first official recognition of his attainments was in 1885, when he was appointed Honorary Entomologist to the Department of Agriculture at Ottawa, and in that capacity, though much hampered by his duties in the library, he published a valuable report on the injurious insects of the year. Two years later his present position of Entomologist and Botanist to the experimental farms of the Dominion was conferred upon him. In the ten years that have now gone by, he has done an enormous amount of valuable work as shown in his Annual Reports and Evidence before the Standing Committee of the House of Commons on Agriculture, his voluminous correspondence with farmers and fruit growers all over the Dominion, and his addresses to Farmers' Institutes and other gatherings. No one in this country has done so much as he to instruct the people in a practical knowledge of their worst insect foes and the best methods of dealing with them, while probably no one but he could have given the Province of Manitoba the information and the advice that he has repeatedly afforded by his lectures, addresses and publications on the noxious weeds of that portion of the Dominion. All his friends will, we are sure, unite with us in the earnest wish that he may long be spared to carry on his admirable work which is of such vast importance, not only to those directly interested in the products of the soil, but to all the dwellers throughout this wide Dominion.

C. J. S. B.

BOOK NOTICES.

INSECT LIFE ; AN INTRODUCTION TO NATURE-STUDY AND A GUIDE FOR TEACHERS, STUDENTS AND OTHERS INTERESTED IN OUT-OF-DOOR LIFE : By John Henry Comstock, Professor of Entomology, in Cornell University and in Leland Stanford Junior University, with many illustrations engraved by Anne Botsford Comstock. New York, D. Appleton and Company, pp. 340, with 6 plates and many figures. Price $2.50.

In this little book Prof. Comstock has given us a treatise, not only of practical value to teachers and amateurs, but also one that the professional worker will find very handy to have just within reach in order to settle some minor point that may suddenly present itself. Best of all, however, is the fact that the work is correct, a feature quite in contrast with some of the ordinary text-book entomology. There need be no hesitation about recommending this book to anyone, as its style, while not especially technical, is even more or less poetical, yet is never flippant or slipshod in expression. The illustrations are fine and are not simply pictures, but help to simplify the text; almost anyone who is at all versed in entomology will at once recognize the Katy-did on the cover. There is just one fault to be found with the book, and it is very doubtful if this is to be attributed to the author, and this is the title. A fascinating title may help to sell a novel, or some such work as that, but publishers should learn that this is not true with such books as this. However, it is no discredit to the author that his book should be found better than its title. For the present, and until there is something much better, I shall recommend this book to those who wish a simple and accurate introduction to the difficult study of entomology. F. M. W.

STORIES OF INSECT LIFE : By Clarence Moores Weed, Ginn and Company, publishers, Boston, U.S.A, and London, pp. 54, with many illustrations. Price 25c.

The title indicates the nature of the book, and no one will mistake the figure of the well known "Mourning Cloak" Butterfly on the front cover, even though no attempt was made in the way of colour. This is for the young people, and just the thing for boys and girls who are romping and playing over the fields and meadows, securing that most important element in an education, health. The insects treated of are the most common, and this is a great advantage because it is usually the things that are the nearest to us that we know the least about. Get the children to observe the common things carefully, and they will be all the better prepared to look after the uncommon later on in life. I only wish that some philanthropist would buy up the whole edition of this work and present them to the school children of the country. Surely it would help to make better men and women of many boys and girls, and open up them a world of wonders that are to be seen by any, no matter how lowly, provided they only know how and where to look. F. M. W.

GUIDE TO THE GENERA AND CLASSIFICATION OF THE NORTH AMERICAN ORTHOPTERA : By S. H. Scudder. 8vo. pp. 89. W. H. Wheeler, Cambridge, 1897. Price, $1.00.

The above volume, like all of Dr. Scudder's books, is exactly what the title states. It is simply a guide for the use of students of the Orthoptera by means of which they may determine the genera of their specimens. It consists of excellent and most carefully prepared tables of the seven families into which the Orthoptera of North America are divided. These are followed by most valuable bibliographical notes in which the student is referred under the head of each family of insects to all the works which refer to it. Then follows a full list of all the works which refer to North American Orthoptera, arranged alphabetically by authors and a complete index. All who have attempted to study Orthoptera know how badly such a book was wanted, and it is well for the science of entomology that the work was done by such a careful and experienced hand.

J. F.

The Genera of North American Melanopli: By S. H. Scudder. (Proc. Am. Acad. of A. and S. V. 32, pp. 195-206, January, 1897.)

Almost simultaneously with Dr. Scudder's "Guide to the Genera of Orthoptera" two other important and extremely useful papers appeared, one on "*The Genera of North American Melanopli*," and the other on "*The Species of the Genus Melanoplus*." These are both really advance issues of chapters in Dr. Scudder's great work on the Melanopli, which is to be published by the U. S. National Museum. The *Melanopli* are divided into thirty genera, seventeen of which are new and four have been previously published by the author. The genus *Melanoplus* is characteristically American and is widely disseminated. There are 131 species recognized, grouped under twenty-eight series. The name *furcula* is given to the processes of the last dorsal segment of the male abdomen. J. F.

The Book of British Butterflies: A practical manual for Collectors and Naturalists; 1 vol. pp. 247 (3s. 6d.)

The Book of British Hawk-moths: A popular and practical Hand-book for Lepidopterists; 1 vol. pp. 157 (3s. 6d.)

By W. J. Lucas, B. A. London: L. Upcott Gill, 170 Strand, W. C.

Many excellent works on British butterflies have been published during the last twenty five years and one would naturally suppose that there was little need of another book on the subject. Mr. Lucas, however, has succeeded in producing a very useful and excellent popular manual, which will be a welcome aid to those who wish to study the life history of butterflies as well as to identify the specimens they may collect in the British Isles. As it is intended for those who have made no previous study of the subject, the author begins at the beginning, telling the reader what an insect is, what place the butterfly takes in nature, how to capture, set and care for specimens, and then describes each British species from the egg to the imago in clear and simple language, and in almost every instance gives admirable drawings of the caterpillar, chrysalis and both surfaces of the imago. As there are no less than 266 figures in illustration of sixty-eight species, the collector should have no difficulty in determining any specimen of butterfly in any of its stages (except the egg) that he may chance to find. A book such as this should give a great impetus to the study of the preparatory stages of British butterflies, a section of entomology which is usually neglected in favor of the mere collection and arrangement of the perfect insects. A volume such as this on Canadian butterflies would be a very welcome aid to a large number of young people whose interest has been aroused by the beauty and variety of our species, but whose enthusiasm is dampened by the difficulty of obtaining any information about them.

"The Book of British Hawk-moths," by the same author, deals with a somewhat less familiar group, and gives much useful information that it would otherwise be hard to find. The plan of the work is similar to that of the butterfly book, and it is written in the same clear and simple style. As there are only seventeen species to deal with, the writer is able to go more fully into details respecting them and to make his work all the more complete and popular. He has also provided artificial keys to the larvæ and imagines, and tables for distinguishing the species where there is more than one representative of the genus. The fifteen plates with which the volume is illustrated are very beautiful and are admirably drawn by the author himself. Each species is represented life size, and is shown as a caterpillar on its food plant, chrysalis and imago. There are eighteen wood cuts for the most part illustrating details of structure. It is to be hoped that the author will continue his good work until he has completed the British lepidoptera, or at any rate the more conspicuous and familiar families. C. J. S. B.

Life Histories of American Insects: By Clarence M. Weed. 1 vol. pp. 272. ($1.50). New York: The Macmillan Company.

The publication of a popular book on insects is so rare an event on this side of the Atlantic that we heartily welcome an addition to the number, especially when it is so

excellent and satisfactory as the volume before us. Dr. Weed has selected some five and twenty more or less familiar insects, and in a pleasant manner has given some account of their life histories. The chapters are quite independent of each other and arranged in no particular order ; the book may therefore be opened at random, and the sketch that may be hit upon read without any detriment to the continuity of the work. Some of them which deal with such creatures as the leaf miners are naturally very brief since so little is known about these tiny foes to vegetation, but of other species which have been subjects of particular study on the part of the author we find long and full descriptions. Among the latter may be mentioned the interesting account of the hibernation of aphides, the chapter on "harvest spiders, the "army worm," etc. Any-one, young or old, who has any desire to read about the wonderful creatures that inhabit the world and to know something about their modes of life cannot fail to be pleased with this book, and to be led on we should hope to make his own observations of their curious habits and strange doings. The volume is handsomely illustrated with twenty-one full page plates and nearly 100 figures in the text. C. J. S. B.

Insects and Spiders : Their Structure, Life Histories and Habits. By J. W. Tutt. 1 vol., pp. 116. (1 shilling). London : George Gill & Sons, Warwick Lane, E.C.

In the annual report of the Entomological Society of Ontario for 1896 much attention was paid to the subject of teaching natural history, and especially entomology, in schools, and the desire was expressed that some hand book might be drawn up for the assistance of teachers in rural schools. The volume before us is the very book that is needed, if only it dealt with Canadian instead of British insects. In England "Object lessons" are a compulsory part of the curriculum in elementary schools, and the teachers are required to give their pupils a series of simple lessons "adapted to cultivate habits of exact observation, statement and reasoning." These lessons are to be "on objects and on the phenomena of nature and of common life," and a wide discretion is thus left in the hands of the teacher. In the country schools of Ontario no subject could be more useful than the study in this way of the commonest species of injurious and beneficial insects, and no subject is likely to compare with it in interesting the pupils A further advantage is the ease with which specimens can be obtained and their life histories traced. Mr. Tutt's volume is admirably adapted for the use of teachers in providing lessons of this kind. After giving a general account of the external structure of insects, their internal organs and metamorphoses, he devotes the "lessons" to typical common species of each order, giving similar particulars regarding the individuals and any general facts of interest that bear upon them. Each insect treated of is also illustrated with plates and wood cuts. It is not, however, a text-book for pupils, but is meant for the instruction and equipment of the teachers, affording them an excellent foundation upon which to frame the instructions they are to give to those committed to their charge.

C. J. S. B.

SUPPLEMENT.

AN ACT TO PROTECT CANADA AGAINST THE INTRODUCTION OF THE INSECT PEST KNOWN AS THE SAN JOSÉ SCALE.

Assented to March 18th, 1898.

Her Majesty, by and with the advice and consent of the Senate and House of Commons of Canada, enacts as follows :—

Short title.

1. This Act may be cited as *The San Jose Scale Act.*

Importation of nursery stock from certain places prohibited.

2. The importation of any trees, shrubs, plants, vines, grafts, cuttings or buds, commonly called nursery stock, from any country or place to which this Act applies is prohibited.

Penalty.

3. Any nursery stock so imported shall be forfeited to the Crown, and may be destroyed, and any person importing nursery stock from any such country or place, or causing or permitting it to be so imported, shall be deemed to be guilty of an offence under section 6 of *The Customs Tariff, 1897*, and shall be liable to the penalty prescribed by that section.

Application of Act to be regulated by Governor in Council.

4. The Governor in Council may from time to time declare that this Act applies to any country or place as to which it has been made to appear that San José Scale exists therein ; and, when satisfied that the importation of nursery stock from any country or place to which this Act has been applied may safely be permitted, he may in like manner declare that this Act no longer applies to such country or place.

Exemption of plants which are not liable to San José Scale.

5. The Governor in Council, upon its being made to appear to his satisfaction that any class of plants is not liable to the attack of the San José Scale, may exempt plants of such class, and grafts, cuttings or buds thereof from the operation of this Act.

Importation for scientific purposes.

6. The Governor in Council may from time to time, notwithstanding anything contained in this Act, permit the importation from any country or place to which this Act applies, of any such nursery stock as is required for scientific purposes.

Publication of Orders-in-Council.

7. All Orders in Council made under sections 4 and 5 of this Act shall be published in *The Canada Gazette.*

ORDERS IN COUNCIL.

At the Government House at Ottawa,

Friday, the 18th day of March, 1898.

PRESENT : HIS EXCELLENCY THE GOVERNOR-GENERAL IN COUNCIL.

His Excellency, in virtue of the provisions of section 4 of the Act passed during the present session of Parliament, cited as "The San José Scale Act," and by and with the advice of the Queen's Privy Council, is pleased to declare that the United States of America, Australia, Japan and the Hawaiian Islands shall be and the same are hereby declared to be countries to which this Act applies owing to the existence of the San José Scale in them.

JOHN J. MCGEE,

Clerk of the Privy Council.

At the Government House at Ottawa,
Friday, the 18th day of March, 1898.

PRESENT: HIS EXCELLENCY THE GOVERNOR-GENERAL IN COUNCIL.

His Excellency, in virtue of the provisions of section 5 of the Act passed during the present session of Parliament, and cited as "The San José Scale Act," and by and with the advice of the Queen's Privy Council, is pleased to order and declare that the following plants which are not liable to the attack of the San José Scale, viz. :—

1. Greenhouse plants, with the exception of roses,
2. Herbaceous perennials,
3. Herbaceous bedding plants,
4. All conifers,
5. Bulbs and tubers,

shall be and the same are hereby exempted from the operations of the above mentioned Act.

JOHN J. MCGEE,
Clerk of the Privy Council.

ONTARIO DEPARTMENT OF AGRICULTURE.

AN ACT TO PREVENT THE SPREAD OF THE SAN JOSE SCALE.

Passed January 17th, 1898.

Her Majesty, by and with the advice and consent of the Legislative Assembly of the Province of Ontario, enacts as follows:

1. This Act may be cited as *The San Jose Scale Act*. Short title.

2. In this Act the word "Minister" shall mean the Minister of Agriculture for the Province of Ontario. Interpretation "Minister."

The word "plant" shall mean any tree, vine, shrub or plant, or any part of a tree, vine, shrub or plant, or the fruit of any tree, vine, shrub or plant. "Plant."

The word "scale" shall mean the San José Scale insect in any of its stages of development. "Scale."

3. No person shall import or bring, or cause to be imported or brought into the Province of Ontario, for any purpose whatsoever, any plant infested with scale. Importation of diseased plants prohibited.

4. No person shall keep or have, or offer for exchange or sale, any plant infested with scale. Having in possession or selling.

5. For the purpose of scientific investigation the Minister may from time to time, by writing given under his hand, except such persons as he may deem proper, from the operation of the two preceding sections, and, while acting under such permission, such persons shall not be subject to the penalties imposed by this Act. Scientific investigation.

6. Any person having reason to suspect that any plant in his possession, or in his charge or keeping, is infested with the scale shall forthwith communicate with the Minister in regard to the same, and shall furnish the Minister with all such information in regard to the source or origin of the said infestation and the extent and nature of the same as he may be able to give. Notice to Minister on discovery of disease.

Investigation and report.

7. Whenever the scale exists, or is supposed to exist on any plant, the Minister may direct a competent person to make an examination and inspection, and may order that any plant so infested, or such part as he may deem advisable, shall be immediately destroyed by burning, either by the person appointed to make the inspection or by the person owning or having possession of the said plant, or some other person so directed in writing, and the person so directed shall make a full report to the Minister in writing as to the nature and extent of the work so performed, together with a fair estimate of the value of the plant destroyed.

Destruction of diseased plant.

Duties of inspectors appointed under Rev. Stat. c. 280.

8. For the purpose of enforcing this Act, it shall be the duty of every inspector appointed under *The Yellows and Black Knot Act* to make careful examination and inspection for the occurrence of the scale within the municipality for which he is appointed, and to report forthwith every case of infestation, and neglect to make such report shall render the inspector liable to the penalties imposed under section 11 of this Act.

Right of access to places where tree is.

9. Any person appointed by the Minister under this Act to inspect or to destroy any plant for the purpose of enforcing the provisions of this Act, shall, upon producing his authority in writing, have free access to any nursery, orchard, store, storeroom or other place where it is known or suspected that any plant is kept.

Compensation for destruction of plants.

10. Upon the recommendation of the Minister there may be paid out of the Consolidated Revenue Fund of the Province to the owner of any plant so destroyed a sum not exceeding one-fourth of the value thereof (not including fruit) as reported upon by such officer or other competent person appointed as aforesaid; but nothing in this section shall apply to any plant imported into the Province within a period of one year prior to the examination by the officer aforesaid.

Penalty.

11. Any person neglecting to carry out the provisions of this Act, or any person offering any hindrance to the carrying out of this Act, shall, upon summary conviction, be liable to a fine of not less than $20 nor more than $100, together with costs, and in default of payment thereof shall be subject to imprisonment in the common gaol for a period of not less than ten days nor more than thirty days.

Extension of Act to other scale insects.

12. The Lieutenant-Governor in Council may by order direct that other scale insects than the San José Scale may be included in the provisions of this Act, and thereafter during the continuance of such Order-in-Council the word "scale" in this Act shall include all such other scale insects. Public notice of such Order-in-Council shall be given by publication in two successive issues of *The Ontario Gazette*.

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TWENTY-NINTH ANNUAL REPORT

OF THE

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OF

ONTARIO.

1898.

(PUBLISHED BY THE ONTARIO DEPARTMENT OF AGRICULTURE, TORONTO.)

PRINTED BY ORDER OF

THE LEGISLATIVE ASSEMBLY OF ONTARIO.

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TWENTY-NINTH ANNUAL REPORT

OF THE

ENTOMOLOGICAL SOCIETY OF ONTARIO,

1898.

To the Honorable John Dryden, Minister of Agriculture.

Sir,—I have the honor to present herewith the twenty-ninth annual report of the Entomological Society of Ontario. It contains an account of the proceedings at our annual meeting, which was held in the City of Montreal, on the 8th and 9th of November last. The change from London, the usual place of meeting and the headquarters of the society, was made in order that the members generally might join in the celebration of the twenty-fifth anniversary of the formation of the Montreal Branch. The report includes the financial statement of the Treasurer and the reports of the various sections, branches and officers of the society, as well as the papers and addresses delivered during the course of the meeting.

The *Canadian Entomologist*, the monthly magazine published by the society, has now completed its thirtieth volume and begun the issue of the thirty-first. The volume contains a large number of valuable original papers contributed by the most eminent writers in this department of science in Canada and elsewhere. Great attention, it may be observed, has been paid to scale insects and a great many new species from different parts of North America have been described.

I have the honor to be, Sir,

Your obedient servant,

CHARLES J. S. BETHUNE,

Editor.

Trinity College School,

Port Hope.

OFFICERS FOR 1898-9.

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" 3	ARTHUR GIBSON	Toronto.
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	REV. C. J. S. BETHUNE, M.A., D.C.L., F.R.S.C., Head Master Trinity College School	Port Hope.
	JAMES FLETCHER, LL.D., F.R.S.C., F.L.S., Entomologist and Botanist, Experimental Farms	Ottawa.
	JOHN DEARNESS, I.P.S.	London.
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Committee on Field Days	DR. WOOLVERTON, MESSRS. BALKWILL, BOWMAN, ELLIOTT, LAW, PERCIVAL, RENNIE, SAUNDERS, and SPENCER	London.
	DR. HOTSON	Parkhill.
Library and Rooms Committee	MESSRS. BALKWILL, BETHUNE, DEARNESS, MOFFAT, and SAUNDERS.	

ANNUAL MEETING OF THE ENTOMOLOGICAL SOCIETY OF ONTARIO, 1898.

The thirty-fifth* annual meeting of the Entomological Society of Ontario was held at Montreal, in the Museum of the Natural History Society, on Tuesday and Wednesday, November 8th and 9th, in order that the members might join in the celebration of the twenty-fifth anniversary of the formation of the Montreal Branch. At the request of the President, Mr. Henry H. Lyman, the chair was occupied by the Rev. Dr. Bethune, of Port Hope.

The meeting was called to order at 2-30 p.m. on Tuesday, when the following members were present: Dr. Wm. Saunders, Director, and Dr. James Fletcher, Entomologist and Botanist, Experimental Farms, Ottawa; Messrs. John Dearness and W. E. Saunders (Secretary) London; Mr. Arthur Gibson, Toronto; Rev. C. J. S. Bethune, Port Hope; Mr. J. D. Evans, Trenton; Rev. Dr. Fyles, South Quebec; Messrs. H. H. Lyman, A. F. Winn, J. T. Hausen, Lachlan Gibb, M. Waring Davis, G. C. Dunlop, D. Brainerd, A. E. Norris, H. Brainerd, J. B. Williams, Chas. Stephenson, Rev. Dr. Campbell, and others, Montreal.

The President read letters expressing regret at their inability to attend the meeting, from the following prominent American entomologists: Dr. L. O. Howard, Director of the Division of Entomology, U.S. Department of Agriculture, Washington, D.C.; Rev. Dr. W. J. Holland, Chancellor of the Western University of Pennsylvania, Allegheny, Pa.; Professor F. M. Webster, Wooster, Ohio; Professor M. V. Slingerland, Cornell University, Ithaca, N.Y.

The report of the Librarian and Curator, Mr. J. Alston Moffat, was read by the Chairman, showing 47 additions to the Library, which make the total number of volumes 1,553, and satisfactory work in the increase of the collections.

The Chairman next read the report of the Treasurer, and explained that the large balance in hand on the 1st of September last, when the books were closed, would be greatly reduced by the payments that became due between that date and the end of the year. A discussion upon cork and pins then ensued. Dr. Fyles exhibited a sample of a substitute for cork that had been placed upon the market. Dr. Fletcher enquired why the quality of the cork recently supplied by the Society was so poor. The Secretary replied that he thought a better quality could be procured by paying a higher price for it. Dr. Fletcher considered that we should have the best obtainable, as the present supply was unsatisfactory. Mr. Lyman exhibited some specimens of English-made steel pins, both gilt and black enamelled, and the Secretary was authorized to procure a moderate supply in order that the members might use them if they wished.

The Report of the Botanical Section was then read by the Chairman. Dr. Fletcher made enquiries as to *Cuscuta epithymum*, a dodder which has been found upon clover in the County of Middlesex. Mr. Dearness assured him that it had been correctly identified. He then said that it was a true annual, growing from seed each year.

The Report of the Microscopical and Geological Sections were next read by the Chairman, who remarked that London had become a headquarters of scientific research for the western peninsula of Ontario, in consequence of the good work done by the Society and its sections. It was certainly an unique matter that so many branches devoted to different departments of science should be affiliated together in connection with the Entomological Society of Ontario.

The Reports of the local Branches of the Society were next read; that of the Montreal Branch by its Secretary, Mr. Lachlan Gibb; the report of the Toronto Branch

* By an error it is stated in the last annual Report that "the thirty-fifth annual meeting" was held in 1897. As the Society was founded in 1863, this is manifestly a mistake.

also by its Secretary, Mr. Arthur Gibson; and the report of the Quebec Branch by its President, the Rev. Dr. Fyles. These reports all gave evidence of much good work accomplished, and steady progress in interest and numbers.

The Report of the Delegate to the Royal Society of Canada was read by Mr. John D. Evans, of Trenton, who represented the Entomological Society at the last annual meeting in May. It contained a brief record of the work that had been done during the previous year.

The Report of the Council of the Society was read by the Secretary, Mr. W. E. Saunders, of London, as follows:

Report of the Council.

The Council of the Entomological Society of Ontario submits herewith its Annual Report for the year 1897–8.

The Council is pleased to be able to report that the three Branches of the Society in Montreal, Toronto, and Quebec, are in an active and vigorous condition, much good work having been done in all of them during the past season. The membership of the Branches, the meetings held, and the particulars of their work will be found in their respective reports.

The twenty-eighth annual Report on economic and general Entomology was presented to the Minister of Agriculture for Ontario, at the end of December last, and was printed and distributed at the close of the session of the Legislature. It contained one hundred and four pages, and was illustrated with fifty-six wood-cuts and two full-page plates, in addition to an account of the proceedings at the last annual meeting. The report contains the annual address of the President, Mr. John Dearness, and the following valuable and interesting papers: "The Locusts of the Bible," by Rev. T. W. Fyles; "A Study of the Gryllidæ (Crickets)," by Mr. Wm. Lochhead; "The Value of Systematic Entomological Observations" and "Protective Resemblances," by Mr. J. A. Moffat; "On Butterfly Books, by Mr. H. H. Lyman; "Some Household Pests," by Rev. C. J. S. Bethune; "On the Entomological Results of the Exploration of the British West India Islands by the British Association for the Advancement of Science," by Dr. L. O. Howard; "The Work Against the Gypsy Moth, 1897," by Mr. A. H. Kirkland; "Notes on the Insects of the Year," by Messrs. Harrington, Bethune, Moffat, Fyles, Gibson and Grant; "The San Jose Scale," by Dr. James Fletcher; and a short account of the proceedings at the annual meeting of the Association of Economic Entomologists. The report on the whole contains a larger number than usual of distinctly practical and popular papers that cannot fail to be of great value to the community. These papers were specially prepared by members of the Society in order to afford useful information on a great variety of insects, free as far as possible from scientific and technical language, to farmers, gardeners, fruit-growers, and others affected by the ravages of destructive insects.

The *Canadian Entomologist*, the monthly magazine published by the Society, completed its twenty-ninth volume in December last. Eleven numbers of the thirteenth volume have been issued; they contain 296 pages, and are illustrated with six full-page plates, one of which is colored, and a number of original wood-cuts. Among the many valuable papers may be mentioned a series of articles on "The Classification of the Horntails and Saw-flies of the World," by Mr. William H. Ashmead, and "The Descriptions of a Number of New Species of Scale Insects," by Mr. T. D. A. Cockerell, and others.

Friends of the Society will note with pleasure, that one of our officers, Mr. Wm. Lochhead, has been appointed to the important position of Professor of Biology, in the Ontario Agricultural College, at Guelph. The College is to be congratulated on having made so wise a choice in filling the vacant position.

Since our last meeting, great efforts have been made by the Legislature of Ontario and the Federal Government, to eradicate such colonies of the San Jose Scale as have been found in Canada, and to prevent further introductions of this injurious pest. In our last report will be found the Federal and Provincial Acts bearing upon this subject. These Acts have been vigorously enforced during the past season, and orchards, in districts where the Scale has been found, have been subjected to a rigid inspection. Exceptional efforts have been made by the Provincial Government, to wipe out all traces of this pest, the increase of which, as everyone who understands the matter knows, would be a national calamity.

The members of the Council are gratified to know that the excellent work of one of its oldest and most esteemed members has been recognized by the University of Bishop's College, Lennoxville, Que., the Rev. Thomas W. Fyles having received, at its hands, the degree of D.C.L. The excellent work of Dr. Fyles in encouraging the public taste for Entomology, by his popular papers on insects, and by the formation, in 1897, of the Quebec Branch of the Entomological Society is well known to all our members.

The Council profoundly regrets the loss by death of Prof. Panton, of the Ontario Agricultural College, at Guelph, who at the time of his decease was Vice-President of the Society. He was highly esteemed and respected by the members, both for the efficient assistance he has rendered the cause of Practical Entomology in Canada, and the agreeable and courteous manner which ever characterized his intercourse with all who came in contact with him.

The Council has much pleasure in stating that entomological books can now be imported into Canada free of all Customs duty, and that this concession was obtained through the representations of our Society. Early in the year, the President called the attention of the Council to the fact, that under item No. 464 of the tariff, books upon the application of science to industries of all kinds could be imported free of duty, and suggested that an effort should be made to secure the placing in the same category books upon entomology, on account of the close connection between that science and the successful prosecution of agriculture. This was unanimously approved by the Council and a Committee consisting of the President and Drs. Bethune and Fletcher, was appointed to prepare a memorial to the Government. The memorial having been approved, was signed by the President and Secretary, and was duly forwarded to the Finance Minister on the eve of the introduction of the budget, but owing to the pressure of other business was held over until the prorogation of Parliament. It was referred to the Minister of Customs, who requested the President to furnish more information, and to submit samples of books. On this being done, the Hon. Mr. Patterson, at once decided that such books should be admitted free under the item above referred to.

The Society was represented at the meetings in Boston, in August last, of the Association of Economic Entomologists of North America, and the American Association for the Advancement of Science, by its President, Mr. Lyman and the Rev. Dr. Bethune.

The Council desires to express its entire satisfaction with the efficient manner in which the Librarian and Curator, Mr. J. Alston Moffat continues to discharge the duties of his offices.

All of which is respectfully submitted,

HENRY H. LYMAN,

President.

The adoption of the report of the Council was moved by Mr. Dearness, who also said that it would be interesting to have inserted in the report of the Montreal Branch, some details regarding their Saturday afternoon lectures for young people ; upon being seconded by Mr. L. Gibb, the motion was put to the meeting and unanimously adopted.

REPORT OF THE LIBRARIAN AND CURATOR FOR THE YEAR ENDING 31ST AUGUST, 1898

The bound volumes received in exchange from Government and public institutions during the year were 9: By gift—From Miss Ormerod, through Dr. Fletcher, Kollar's "Treatise on Insects Injurious to Gardeners and Farmers," and from Rev. Dr. Bethune, "The Life and Adventures of Audubon." By purchase—"A Systematic Arrangement of British Plants," and Grote's "Illustrated Essay of 1882." The number of volumes bound was 34. The number of volumes added to the library during the year was 47. The full number now on the register is 1,553. The number of volumes issued to local members was 19.

Several valuable additions have been made to the collection of native lepidoptera during the year by Mr. J. W. Bice, from his captures at electric light.

An important extension was made in the exotic collection by the receipt of a large number of attractive Japanese butterflies and moths in excellent condition from the Rev. H. Loomis, Yokohama, Japan.

Respectfully submitted,

J. ALSTON MOFFAT,

Librarian and Curator.

REPORT OF THE BOTANICAL SECTION.

The President and Council of the Entomological Society:

GENTLEMEN,—During the season just past, the meetings of the Botanical Section have been held with good regularity, beginning with April 20, and continuing every second week until midsummer was over. The members have been actively engaged in the study of the various departments and three plants new to the district of London have been found and exhibited to the meetings, namely, *Linaria minor*, *Galium cinereum*, *Fraxinus quadriangulatus;* and others of particular rarity have been noted:—Asclepias similar to Purpurea but whose species was not satisfactorily determined, *Melissia officinalis* and *Ranunculus bulbosa*, Fleshy Fungi have been the recipients of considerable attention on the part of some of the members and a more general interest has been awakened in this branch.

Some points brought out at the meetings which are of sufficient interest to be menmentioned in our report are as follows:—*Lactuca scaevola* is reported from various quarters and is said to be spreading throughout the County of Middlesex and others adjoining. It is said to be a pernicious weed and some farmers complain very much of its abundance and troublesomeness.

Cuscuta epithymum, a dodder which has been found flourishing only on clover, and of which there were several reports last year, was found again in the same localities this year.

The lateness of the present summer season is also worthy of note. At the time of writing (Oct. 22), wild specimens of *Liatris cylindracea* are in bloom, and in the garden *Anemone Japonica* is full of buds and flowers, while the Phloxes, annual and perennial, and also roses and carnations are still yielding flowers; apple, pear and peach trees in the gardens, maples, elms, and even the ash trees are still in almost full leaf, many of them, particularly the three former, being quite green. Local records show that not for 17 years has there been so late and open a season.

Respectfully submitted for the Botanical Section,

I. BOND,
Chairman.

W. E. SAUNDERS,
Secretary.

REPORT OF THE MICROSCOPICAL SECTION.

The President and Council of the Entomological Society of Ontario:

Gentlemen,—I have the honor to present the report of the Microscopical Section of the Entomological Society of Ontario.

Meetings were begun in November, officers being elected as follows, Chairman, J. A. Balkwill; Sec'y, W. E. Saunders; Committee, Messrs. Rennie, Saunders and Balkwill.

Nine meetings were held at which five sets of papers were given, a good attendance recorded and much interest manifested. A good many slides were mounted by the members and a great deal of interesting and instructive discussion on microscopical subjects was engaged in.

The papers read comprised,—

Shine moulds, by J. Dearness, London.

Bacteria, by Dr. H. A. Stevenson, London.

Radiolaria, by R. W. Rennie, London.

Diatoms, by J. Dearness, London.

Marine Algæ, by R. Lees, M.A., St. Thomas.

Submitted on behalf of the Section,

J. A. Balkwill,
Chairman.

W. E. Saunders,
Secretary.

REPORT OF THE GEOLOGICAL SECTION.

To the Entomological Society of Ontario:

The Geological Section of the Entomological Society of Ontario begs leave to present the following report:

The section continued to meet weekly throughout the year. A special study of the fauna of early geological time was made through the medium of fossils from the Silurian and Devonian formations as developed in south-western Ontario, assisted by charts of the characteristic organic life of these periods.

Special trips to interesting points in our western peninsula were made by various members of our section, and reports of their observations were subsequently made. Among other places visited were the following:—Kettle Point (Cape Ipperwash), by Dr. Woolverton, the chairman of the section; the Crystal Cave at Put-in Bay, Ohio, by Mr. Percival; the bituminous shales of Alvinston, Lambton Co., Ont., by Mr. Sangster; the new oil fields in Sarnia township, Ont.; the Guelph formation as developed at Galt, Ont., by Mr. Goodburn. The chairman of the section also visited the new oil fields at Dutton. Commendable interest was manifested in the general study of geological science.

Appended are abstracts of the reports made of field observations.

Dr. Wolverton's report on Kettle Point and its concretions:

"To the lover of natural history, and especially to the geologist, there is no place in our western peninsula that is of greater interest than this.

"Kettle Point is composed of bituminous shales which overlie the Hamilton formation and which are here the highest member of the Devonian series. The chief feature of this point is the large number of concretionary bodies strewn along the shore, washed

there from the shales which extend as shoals far into Lake Huron. These concretions vary in size from a foot to five feet in diameter. Their composition is limestone, colored by bituminous matter. They are crystalline and radiate from a centre. They resemble fossilized wood. When exposed to the action of the air they usually divide through the centre forming hemispheres.

" As they are being wantonly destroyed by visitors there should be legislative protection provided for these curiosities as soon as possible.

" The shales here present a fine tesselated appearance. The vertical cleavage runs in parallel straight lines at different distances, and the general appearance is much the same as it would be had these shales been placed in position by skilled workmen. Quantities of pyrites are found in these shales. The iron oxidizing tinges with red the boulders along the shore.

" By decomposition of the shales, quantities of alum are produced. This the Indians, from time immemorable, have used as medicine and a commodity for barter. Many years ago fire raged among these shales and consumed a great part of the peninsula which previously had extended far into the lake."

Mr. Percival's report on the celestine grotto at Put-in-Bay:

" It having been reported to the section that a curious crystal cave had recently been discovered on an island at the western extremity of Lake Erie, I decided to visit it and report. The cave was discovered a year ago by workmen engaged in digging a well. At a depth of about twenty feet a fissure was discovered at one side of the well, and further excavation revealed a beautiful little cavern everywhere lined with crystalline strontium sulphate (celestine). The owner having lighted the well by electricity the effect is very fine. The crystals are rhombic, of a beautiful azure blue, and vary in size from one inch to twenty inches in transverse axis. As the cavern is everywhere lined by these crystals it may be considered a gigantic geode. The cave is semi-circular in form and about forty feet in perimeter. The arch of the roof however is low owing to the vast deposit of crystals, said to be more than twenty-two feet in thickness, on the floor of the grotto.

" Crevices at several points together with other indications lead to the opinion that this is only one of a series of similar caverns in that vicinity. The owner proposes to continue excavating during the ensuing winter, and probably next summer there will be several grottoes open to the inspection of visitors.

" Strontium is a somewhat rare mineral and occurs nowhere else in large quantity. The element was isolated about a century ago. It is whitish in color, oxidizes readily, decomposes water with explosive violence, and never occurs in organic bodies. It gives a remarkable band of light in the spectrum, by which it is readily detected. Strontium was named after Strontian, in Argyle, Scotland, where it is found as a carbonate. It is also found in Sicily in small quantity. Here however the quantity in sight is quite large. Sr. nitrate is used to give a crimson tint to a flame, and is the chief material used in making Bengal fire (red). Strontium salts are also used in sugar refining to hasten the crystallization of sugar."

Mr. Percival placed beautiful crystals in our geological cabinet in the Entomological Society's rooms, where they may be inspected at any time.

Mr. Sangster's Report on Alvinston Shales.

The outcrop measures 1,400 feet in length, and borings made at various points prove that the depth is sixty feet. The river has eroded the bed to a depth of about eight feet. The shales are similar to those exposed at Kettle Point, but contain no concretions. They are highly carbonaceous and contain much iron sulphide. The shales are capped by a stratum of clay forty feet in thickness.

Experiments made with this shale prove it to be a most valuable material for the manufacture of vitrified brick. A leading manufacturer of paving brick declared no

better material for the purpose had hitherto been discovered on this continent. As a company is being formed to manufacture brick from these shales, it is hoped that soon they will rank among the developed economic products of this Province.

Mr. Sangster exhibited fine specimens of vitrified brick manufactured from these shales.

Mr. John Law, who spent some time among the Catskills, southern New York reported that veins of copper, also platinum, besides traces of gold and silver, had been discovered in these regions. He exhibited specimens of drift boulders from this location; gneiss appeared to be the predominating material. He also exhibited a photograph of a famous drift rock called Eagle Rock. He thinks that prospectors would find it a favorable field for exploration.

Mr. Goodburn visited Galt and reported as follows:

The rocks at Galt are dolomite (in some cases pure) and belong to the Guelph group. They vary in colour, from a dirty yellow to a beautiful grey (the grey being the lowest in the series), and are of a peculiar crystalline texture. They furnish excellent building stones. The Guelph group varies here in thickness from 90ft. to 160ft. The underlying mass is the Niagara group. The upper portions of strata are much broken up, and contained many specimens of the Megalomus Canadensis. This bed was about 15ft. thick. The lower beds were quite compact, and also contained many fossils. One Meg. Can. which I secured is perfect, six inches in length, and larger than any figured in Nicholson's Palæontology. I also found a very good specimen of Megalomus compressus four inches long and a little over one inch in thickness, a portion ot the outer spiral and the whole of the inner cast of a Murchisonia Loganii. The quarry whence I obtained my specimens is near the Grand Trunk track, and about 200 yards from the Grand River.

The Chairman visited the oil fields at Dutton, Elgin Co., Ontario, and reported that the pioneer company operating there had seven producing wells.

Mr. Kirk reported on another new oil field situated in Sarnia Township, Lambton Co., Ontario. One company operating there had thirty producing wells scattered along a line about two miles in length. These produce from 15 barrels per day downwards. They propose to thoroughly develop this tract, and sink a well every 200 feet. The producing area is about one mile in width. Another company working in an adjoining neighbourhood have very recently obtained some good wells, one of which pumps 25 barrels a day. The producing wells are all situated along anti-clinal, which, however, does not appear at the surface, being deeply covered by clay. Oil is obtained here at a depth of about 475 feet. The borings pass through clay 100ft., hard rock 15ft., shale 150 ft., upper lime 15 ft., shale 150 ft., lower lime and sandstone about 45ft. In order to obtain oil each well must be torpedoed, the charge being from 20 to 50 quarts of nitroglycerine. These new oil fields seem to be a northwesterly extension of the petroleum oil belt. The oil is found along a line trending northwest and southeast.

GEO. KIRK,
Secretary.

THE REPORT OF THE MONTREAL BRANCH.

The 215th regular and 25th annual meeting of the Montreal Branch of the Entomological Society of Ontario was held in the rooms of the Natural History Society of Montreal, on May 10th, 1898.

The following members were present: Messrs. H. H. Lyman (President), A. F. Winn (Vice-President), E. T. Chambers, J. B. Williams, Dwight Brainerd, L. Reford, C. Stevenson, G. A. Moore, and L. Gibb; visitor, Mr. M. Waring Davis.

The chair was taken by the President, and the minutes of the previous meeting were read and confirmed, also the last annual report.

The President then submitted the following report of the Council for the past year:

In presenting their twenty-fifth annual report the Council have much pleasure in being able to congratulate the Branch upon having enjoyed a continuous and fairly prosperous existence for a quarter of a century. This, in view of the small number interested in the pursuit of this particular branch of science, coupled with the fact that in this country almost everyone has to work for a living, is, we think, a highly creditable showing.

During the season eight meetings have been held, at one of which we had the pleasure of the attendance of Dr. Fletcher, and at another of that of Rev. Mr. Fyles, and the following papers were read:

Annual address of the President.

Notes on the Collecting Season of 1897—Dwight Brainerd.

On the Food of the common Grass Snake—J. B. Williams.

A late Autumn Ramble on the Mountain—A. F. Winn.

On the Mounting of Lepidoptera—H. H. Lyman.

The San Jose Scale—Dr. James Fletcher.

Further notes on the Genus Chionobas—H. H. Lyman.

Our books and original papers—A. F. Winn.

Our native Pieridæ, a theory—Dwight Brainerd.

Introduction to the Classification of Insects—Rev. T. W. Fyles.

An Arctian: what is it?—Rev. T. W. Fyles.

Life History of Tæniocampa alia, Gn—Rev. T. W. Fyles.

The Dytiscidæ—A. F. Winn.

During the season a number of our members again took part in the course of short lectures to young people on Saturday afternoons at the Natural History Museum. This work is now fairly established, and should be productive of good results in the future.

Our small library, which had suffered greatly in the past through the Branch having no permanent quarters, has received some valuable additions through the kindness of one of our absent members, Mr. Jack, and the Cabinet of the Natural History Society has been materially added to by two of our members, Messrs. Winn and D. Brainerd.

Our Branch has also presented a copy of Comstock's Manual for the study of Insects to the library of that Society as a slight return for privileges accorded to our Branch.

Steps have been taken to secure as far as possible the interchange of papers between the different branches of the Society, that all may get the benefit of such papers. Should this scheme be successfully carried out, it should add materially to the interest of the meetings, and cause the several branches to take more interest in each other's work.

At the last annual meeting of the parent Society our Branch was honored by having one of its members elected to the presidency.

The Treasurer's report shows that the finances of the Branch are in a satisfactory condition.

Respectfully submitted on behalf of the Council,

HENRY H. LYMAN,

President.

The Treasurer then submitted his report, which showed an accumulated balance in hand of $38.68.

Upon the motion of Mr. J. B. Williams, seconded by Mr. L. Reford, the reports of the Council and Treasurer were received and adopted.

The President then read his annual address, giving a resume of the past year's work, and suggesting the holding of a conversazione in the autumn to mark the completion of the 25th year of the Montreal Branch.

The following officers were then elected for the ensuing year :

President—Henry H. Lyman ; *Vice President*—A. F. Winn ; *Secretary-Treasurer*—Lachlan Gibb ; *Council*—G. C. Dunlop, J. B. Williams, Dwight Brainerd.

L. Gibb, Secretary-Treasurer.

REPORT OF THE TORONTO BRANCH.

The second Annual Meeting of the Toronto Branch was held in the Education Department (Normal School) on Friday evening, the 1st April, 1898.

The following members were present : Messrs E. V. Rippon, President : Arthur Gibson, Secy-Treas : H. D. Chipman, C. T. Hills, C. H. Tyers, A J. Cherry, H. C. Austen, S. R. Carter, E. M. Fenwick and Frank Welch.

The minutes of the previous regular meeting were read and approved.

Report of the Council : The Secretary read the following report of the Council for the year ending 31st March, 1898.

The Council of the Toronto Branch of the Entomological Society of Ontario take pleasure in presenting the second Annual Report of the proceedings of the Branch for the year ending 31st March, 1898.

Since our previous Annual Meeting one new member, Mr. E. M. Fenwick, has been added to the roll of membership, and it is earnestly hoped that throughout the year now commencing, the members will endeavor to obtain as many new additions to the roll as possible.

During the year, eighteen regular meetings have been held, and the following papers, contributed by the members, tended considerably to add to the interest manifested in, and the success attending these meetings.

"Parasitic Forms of Insects" by Mr. E. V. Rippon.

"Collecting in and about Kingsville, Ont." by Mr. C. T. Hills.

"Some of the Insect Pests of the Niagara District" by Mr. H. C. Austin.

"Muscular Powers of Insects" by Mr. H. D. Chipman.

"The Mosquito" by Mr. A. J. Cherry.

"On the Noctuidæ Occurring at Toronto" by Mr. Arthur Gibson.

On the 23rd November last the Branch had the pleasure of contributing an illustrated lecture on "Our Friends and Foes of the Insect World", through the kindness of one of our members, Mr. T. G. Priddey, to the eleventh Section of the Boys' Brigade. About 200 boys were present, most of whom took an interest in the discourse, and it is hoped that some stray seed may have fallen into good ground.

During the collecting season three field days were held, viz., on the 24th May to "Trout Creek", on the 19th June to "Trout Creek" and on the 1st July to Forks of Credit.

The Branch is indeed pleased to place on record the appreciation it feels towards the Minister of Education (Hon. G. W. Ross) and the Education Department for Ontario, for their kindness in granting the Branch the free use of a room, in which to hold meetings and store the collection and library.

The report of the Librarian-Curator shows that during the year quite a large number of valuable Government publications have been donated to the Branch, also that the collection of insects is steadily increasing.

The Treasurer's report shows the balance carried forward to be on the right side.

All of which is respectfully submitted.

E. V. Rippon, President.

The report of the Treasurer was presented, as also that of the Librarian-Curator, submitted by Mr. H. D. Chipman. On motion of Mr. Hills, seconded by Mr. Austen, the reports of the Council, Treasurer, and Librarian-Curator, were adopted as read.

The election of officers for the ensuing year resulted as follows:

President—Mr. R. J. Crew; *Vice-President*—Mr. C. T. Hills; *Secretary-Treasurer*—Mr. Arthur Gibson. (accl.); *Librarian-Curator*—Mr. H. D. Chipman; *Members of Council*—Messrs H. C. Tyers and E. M. Fenwick.

The retiring President, Mr. E. V. Rippon, then addressed the meeting. He referred chiefly to the work done during the past year, and while pleased with the result, said he would like to see the members take a more active interest in the work. As regards the collection of insects he hoped the members would contribute as many specimens as they possibly could during the coming season, and pointed out the advantage to all the members in having a representative collection in the possession of the Branch. Of course, it would not be expected that the members would neglect their own private collections, but with a little extra work on the part of each member, he felt satisfied that much progress could be made in the collection during the approaching season. He also referred to the reading of papers at the meetings, and hoped that the members would make an effort to contribute more papers in future. During the past year only six papers were contributed by the members. He encouraged those present to make more notes during the coming season, feeling sure that if such were done more papers would be contributed at the meetings. He mentioned that the outlook for the Branch's future was much brighter than ever before, as the Education Department for Ontario had very kindly granted the Branch the free use of a room in which to hold meetings, and store the collection and Library. He also touched upon the membership and hoped that those connected with the Branch would endeavor to have some new names added to the roll during the ensuing year.

The meeting then adjourned.

Arthur Gibson, Secretary.

REPORT OF THE QUEBEC BRANCH.

The annual meeting of the Quebec Branch of the Entomological Society of Ontario was held on the 26th of February, 1898. Eighteen members were present, the President, the Rev. T. W. Fyles, occupying the chair.

President's Report. The Quebec Branch of the Entomological Society of Ontario is to be congratulated on the success which has attended it during the first year of its existence. Its numbers have increased, its meetings have been regularly held and well attended, and considerable interest in natural history has been awakened in the community through its proceedings. The pleasures of its monthly meetings have been enhanced by the hospitality of its members. This has been so far extended that its gatherings have taken as much of a social as of a scientific character: though the objects of the association have never been lost sight of—"Philosophy in sport" having been made "Science in earnest."

In the course of the summer a number of rare and interesting specimens were taken, and these were afterwards exhibited and identified. Among them were some the names of which were new to the Quebec lists.

The thanks of the members are due to the authorities of Morrin College for the countenance and encouragement they have given to the association.

The Branch was represented by its President at the annual meeting of the Entomological Society of Ontario held in London, Ont., on the 12th of October. On this occasion many hearty good wishes for the prosperity of the Branch were expressed.

The parent society has reached the 35th year of its existence. Its 28th annual report is now in the press. Its monthly organ, *The Canadian Entomologist*, which has now reached its 30th volume, ranks as one of the leading Entomological publications of the day, and has an extensive circulation, not only in Canada and the United States, but in Europe and other parts of the world. Flourishing branches of the Society exist in Toronto and Montreal. The Quebec branch will, we trust, be no less prosperous than these.

The Society has experienced a great loss by the death of its Vice-President, J. Hoyes Panton, M. A., F. G S., Professor of Natural History and Geology, in the Ontario Agricultural College, Guelph. He was the author of a useful handbook entitled "Our Insect Foes and How to Destroy Them." His valuable article on "Entomology for Rural Schools," which appeared in last year's report of the Society, is, no doubt, fresh in the minds of many of you. His useful career was cut short while he was yet in his prime. The American Entomological Society has also sustained a great loss by the death of its President, Dr. George H. Horn. The *Entomological News*, of Philadelphia, thus speaks of him :

"The entomological world has lost a shining light and American Coleopterology its greatest votary. As a systematic coleopterist he probably did not have a superior in the world. His large collection of beetles was considered the finest extant in the field he cultivated. It, with his library, and five thousand dollars for the care of the former, he willed to the American Entomological Society."

Entomology in the United States has made great strides. The Division of Entomology in the Department of Agriculture, Washington, D. C., has been of vast benefit to the agriculturists and horticulturists of this continent. Its present able director, Mr. L. O. Howard, and his efficient staff, are not merely supporting, but raising more and more the high character that its services have won for it. Among the valuable bulletins that it has lately issued are :

"The Gypsy Moth in America," by L. O. Howard.

"Revision of the Tachinidæ," by D. L. Coquillet.

"Some Little-Known Insects Affecting Stored Vegetable Products," by F. H. Chittenden.

"Insects Affecting Domestic Animals," by Herbert Osborn.

The insects that are causing the greatest alarm in America at the present time are the Gypsy Moth (*Porthetria dispar*) and the San Jose Scale (*Aspidiotus perniciosus*) Comstock. Specimens of the former species escaped in 1869 from the residence of Professor Trouvelot, at Medford, near Boston ; and for eight years the insects increased in numbers without exciting much attention. The species has now extended its ravages through a district of 220 square miles, and the State of Massachusetts has expended $775,000 in the effort to exterminate it.

The pernicious scale insect was first noticed in the San Jose Valley, California. It has now located itself in spots from Florida to Canada, and from Washington to New Jersey. Its wide and rapid spread is owing to the fact that it has been 'shipped' with fruit and with nursery stock in all directions, It infests deciduous fruit trees, and, unless prompt measures are taken, an orchard attacked by it will be completely destroyed

in a very few years. Our Canadian Department of Agriculture has taken the alarm, and posters, drawn up by Dr. Fletcher have been widely distributed to draw the attention of fruit-growers to the danger.

But Entomology has not only to deal with insects, more or less obnoxious to man; it brings to our notice the beneficial labors of hundreds of other kinds. It holds up to our admiration the marvellous beauty with which the Creator has gifted many of his lesser creatures, and it brings home to us the teaching that "His tender mercies are over all His works." As it is in grace, so it is in nature, "He that seeketh findeth." The works of the Lord are great, *sought out* by all them that have pleasure therein.

Report of the Council In presenting this, the first annual report of the Quebec branch of the Entomological Society of Ontario, your Council finds that the branch, although not eleven months in existence, has succeded very well in the objects for which it was instituted, viz.: the inculcating and promoting a lively interest in entomology, the collection and classifying of specimens, and bringing the members together in social intercourse, through entomological excursions, lectures and gatherings at each other's houses.

Our membership is now twenty-six, viz.: eighteen adults and eight juniors. We have grounds for hope that, during the present year, it will be largely increased.

Meetings have been held monthly, with exception of the midsummer months, in Convocation Hall of Morrin College, by kind permission of the College authorities, for which courtesy our sincere thanks are due.

Papers have been read and lectures illustrated by diagrams, delivered in the same Hall, which have been numerously attended. Instruction has also been given as to the killing, mounting and preserving of specimens, which has been much availed of; and we are glad to see it, especially amongst our Junior members. Several nicely-mounted specimens, taken during the summer campaign by members of our branch, have been shewn at our meetings and evince keen interest in the study of entomology on the part of almost all.

Papers have been read and lectures given on land beetles, two winged flies, flesh flies, mycetophylidæ (mushroom flies), bombilidæ, parasites, especially those infesting cattle, horses and sheep, and the best means of their extermination (most useful information to the farmer and grazier), as well as the tiger moths—Arctiidæ—Colias interior, etc. The caterpillars have not been forgotten and our "woolly-bear" friend, "Phragmatobia rubricosa," as he sturdily scampers over the snowdrift, lets us know that life is by no means lacking in even the smaller things of creation during a Canadian winter, for he early shows himself, a harbinger of spring.

The want of a proper cabinet for the conservation of insects arose, and through the kindness of a few of the members and friends of the Association, a very handsome one has been obtained, which is placed in Morrin College, and has already received its first instalment of insects.

Before closing what must necessarily be but a brief report, owing to the short time since the organization of the branch, we must call your attention to an item very interesting to our hive of workers, viz.: the treasurer's report, which shows that, after remitting to the parent society the necessary honorarium and paying expenses, we have, out of our subscription list, a balance in hand of $6.70.

Joseph Eveleigh Treffry,

Secretary.

The officers elected for 1898 were:

President—Rev. Thomas W. Fyles; *Vice-President*—Miss Macdonald; *Council*—Hon. Richard Turner, Mr. J. Eveleigh Treffry, Prof. H. Walters, Mrs. R. Turner, Miss Bickell, Miss B. Winfield; *Secretary-Treasurer*—Lt.-Col. Crawford Lindsay; *Curator*—Professor H. Walters.

Since the annual meeting in February the branch has held four regular meetings, and five field-days. On the latter occasions very happy excursions to the Gomin, the Island of Orleans (twice), and Beauport were made.

The branch now numbers twenty-eight adult members and fourteen junior.

CRAWFORD LINDSAY,
Secretary-Treasurer.

QUEBEC, Nov. 5th, 1898.

REPORT FROM THE ENTOMOLOGICAL SOCIETY OF ONTARIO TO THE ROYAL SOCIETY OF CANADA.

Having the honor to represent the Entomological Society of Ontario, I beg leave to submit the following report of its work and proceedings during the past year.

The Society still maintains its former position as to its increasing membership. Its Branches are doing good work, and have given a very considerable impetus to the study of insect life. The Toronto Branch having been inaugurated, commenced its life with the New Year, and later a Branch was formed in Quebec, under the most favorable auspices. The Library has been augmented by an unusually large number of additional volumes, numbering no less than eighty-eight; the total number on the register now being 1,506. Important additions were also made to the Society's collections of insects.

"The Canadian Entomologist," the official organ of the Society, maintains its prestige among its class of literature. The twenty ninth volume of 306 pages was issued during the past year (1897), its contributors numbering forty-four, of whom thirty reside in the United States of America, one in Mexico, one in Germany, and the remaining twelve in Canada. These contributed seventy-six articles, in which were described twenty new genera, one new subgenus, ninety-one new species, and six new varieties.

The following are a few of the more important papers above referred to, viz.:

On the Mexican Bees of the genus Augochlora.—By T. D. A. Cockerell.

The Coleoptera of Canada.—By Prof. H. F. Wickham. Continued through nine numbers, and being also a continuation of a series of articles on the same subject which have appeared during the past three years, making an extremely useful compilation for students in Canadian Coleoptera.

A Generic Revision of the Hypogymnidae (Liparidae)—By Harrison G. Dyar.

Catalogue of the Phytophagous and Parasitic Hymenoptera of Vancouver Island—By W. Hague Harrington, F.R.C.S.

Some new species and varieties of Lepidoptera from the Western U.S.—By Wm. Barnes, M.D.

Descriptions of some new Genera and species of Canadian Proctotrypidæ—By Wm. H. Ashmead.

Synonymical and descriptive notes on North American Orthoptera—By Samuel H. Scudder.

On rearing Dragon Flies—By James G. Needham.

Contribution to the knowledge of North American Syrphidae—By W. D. Hunter.

Preliminary Studies of North American Gomphinæ.—By Jas. G. Needham.

A Generic Revision of the Hypocritidae—By Harrison G. Dyar, Ph.D.

Notes on the Life History of Colias Interior (Scud)—By H. H. Lyman.

The Life History of Epirranthis Obfirmaria, Hbn.—By Rev. Thos. W. Fyles.

Notes on Grapta Interrogationis Fabr.—By H. H. Lyman and A. F. Winn.

Also there appears a number of book notices, correspondence, etc., etc.

The thirty-fifth annual meeting of the Society was held in its new room in the Young Men's Christian Association Building in London on Tuesday and Wednesday, October 12th and 13th, 1897.

The annual report published by the Society to the Department of Agriculture of the Province of Ontario consists of 104 pages, in which is contained a full report of the proceedings of the annual meeting above mentioned, together with the annual address of its President. (The reports and papers contained therein were here enumerated.)

JOHN D. EVANS,
Delegate.

REPORT OF THE TREASURER FOR THE YEAR ENDING 31ST AUGUST, 1898.

Receipts.		Expenditure.	
Balance on hand September 1st, 1897	$ 575 52	Printing	$ 597 85
Members' fees	335 13	Report and meeting expenses	214 00
Sales of Entomologist	196 46	Library	35 92
Sales of pins, cork, etc	74 06	Expense account, postage, etc	133 49
Government grant	1,000 00	Rent	175 00
Advertisements	26 50	Salaries	300 00
Interest	23 87	Pins, cork, etc	36 03
		Balance on hand August 31st, 1898	739 25
	$2,231 54		$2,231 54

We, the auditors of the Entomological Society of Ontario, hereby certify that we have examined the books and vouchers of the treasurer and find them well kept and correct and that the above statement is in accordance with the accounts.

W. H. HAMILTON,
JAS. H. BOWMAN, } Auditors.

STATEMENT OF RECEIPTS AND EXPENDITURE FROM SEPTEMBER 1ST, 1898, TO 31ST DECEMBER, 1898.

Receipts.		Expenditure.	
Balance on hand September 1st, 1898	$ 739 25	Printing	$ 206 45
Members' fees	86 90	Report and meeting expenses	155 73
Sales of Entomologist	15 47	Library	22 51
Sales of pins, cork, etc	11 58	Expense account, postage, etc	22 53
Advertisements	7 00	Rent	100 00
Interest	13 80	Salaries	50 00
		Pins, cork, etc	9 44
	$874 00	Balance on hand 31st December, 1898	307 34
			$874 00

J. BALKWILL, Treasurer.

THE PRESIDENT'S ANNUAL ADDRESS.

By Henry H. Lyman, M.A., Montreal.

Gentlemen,—It is with much pleasure that I welcome you to the thirty-fifth annual meeting of our society, and especially is this pleasure enhanced by the fact that our meeting is held in this city in celebration of the twenty-fifth anniversary of the formation of the Montreal branch.

It is a subject for much congratulation that our society, which started from such small beginnings, has grown to such a large number of members, with associate members all over the world, and that its monthly journal takes so high a place in the field of entomological periodicals. But I think that we in Montreal have some reason to be proud of the fact that we are the third oldest entomological association on this continent, and, without any monetary grant or assistance from Government, have been able to keep our meetings up with great regularity through a quarter of a century.

Two hundred and seventeen meetings have been held, and over 200 original papers have been read by our members, and about 80 of these have been published.

But, to turn to matters of more general interest, when an amateur entomologist, with extremely little leisure to devote to this science, has the honor, or perhaps I should say the misfortune, to be elected to the distinguished position of president of so important a society, the question what he is to do for an annual presidential address becomes at once a serious bugbear.

We amateurs have to take our science in so scrappy a fashion, in such small mouthfuls, that it is generally impossible for us to follow out any continuous line of investigation or experiment, and our work is of too fragmentary a nature to afford material for an important address. True, by reading and study, we might familiarize ourselves sufficiently with the work which has been done in some particular line by other entomologists to enable us to give a fairly accurate review of such subjects, but that seems hardly desirable, unless one can add something of interest from one's own observations.

Many of my predecessors in this office have devoted much of their addresses to a review of the principal injurious insects of the year, but I feel that this subject can be so much better handled by those who are by profession economic entomologists that I prefer to leave that task to them.

It has occurred to me that there are many subjects, some of them small in themselves, perhaps, but which for all that are not without their interest, and I have therefore determined to invite your attention to a sort of entomological omnium gatherum or olla podrida.

But before taking up any of these subjects, it is my painful duty to refer to the sad event which so early in the season, and in the maturity of his powers, deprived our society of our highly respected vice-president. Prof. Panton was elected at the last annual meeting, though unable to attend on account of illness, but I do not think that any one at that time anticipated a fatal termination, and I, certainly, looked forward with pleasure to meeting him at this annual meeting.

But the greatest loss to entomology in America, using the latter term in a wider sense than our neighbors generally use it, which has occurred during the year was unquestionably that sustained in the death of Dr. George H. Horn, who since the death of Dr. J. L. Leconte has been facile princeps among American coleopterists.

By the death of Dr. J. A. Lintner, American economic entomology has suffered a great loss, and I am sure his memory will be cherished by all who had the privilege of his acquaintance. He was a very able entomologist and a kindly, unassuming gentleman.

Among other losses by death especial mention should be made of Prof. Kellicott, of the Ohio State University, but whom I had not the privilege of knowing.

But to turn to less mournful subjects: If I were asked to state what I consider the chief characteristic of entomologists, I think I should say their patience. Surely a man deficient in this virtue would not continue long in the pursuit of this science. Are we ever thoroughly discouraged? Does not hope spring ever fresh in our hearts? We may secure the eggs of a species whose life history we are anxious to enravel, and after carrying the larvæ nearly through, and just when success seems about to reward our patient care, a mysterious disease may sweep the whole brood away, and yet we only say, "I must try it again; better luck next time."

When I think of the myriads of species whose life histories are waiting to be unravelled, of the comparatively few who are engaged in this work, of the few life histories which we can work out in a single season, and of the very few seasons we have in which to do this work, I am inclined to think that the way we go at this task is almost sublime.

But this reflection leads me to what is perhaps a delicate question, and that is—Would it not be better if some of our friends, when working out these life histories, would give less time to debating as to more generalized and more specialized forms?

Surely it will not be contended that a more specialized form is necessarily higher than a more generalized one? There is evolution downwards as well as upwards, specialization towards degradation as well as towards advancement.

I confess that when I find able entomologists laying such great stress upon such minutiæ as one vein being slightly more appressed to another vein in one genus than in some other genus, or the presence or absence of some minute veinlet, when it is admitted that even individuals of the same species show variations in these matters, which fact has to be accounted for on the convenient doctrine of reversion, or when it is proposed to classify families as higher or lower chiefly upon the single characteristic of having or not having the fore pair of legs aborted, my share of the patience to which I have alluded tends to wear thin.

While not a champion of the New Woman, I certainly believe in the doctrine of the equality of the sexes in the case of the Lycænidæ, and protest strongly against any attempt on the part of the gentleman Lycænid to lord it over his spouse on account of his aborted fore legs. The bear has a plantigrade foot, and the domestic fowl is a biped, but it is hardly probable that these facts would lead any systematist to place these animals next to man in the order of classification. We shall never have a natural, and therefore scientific and satisfactory classification of these creatures until we know them in all their stages, when our classification will be based upon the sum of their characteristics.

There is one word which I would like to say to our professional friends, and that is, that I think they might show a little more consideration for the amateurs in the way of giving the reasons for any necessary changes of name. Amateurs have neither the time nor the opportunity to keep up in detail with the tremendous output of entomological literature, and when one takes up a number of a journal containing an instalment of a "revision" of some group, and finds that some well-known name has entirely disappeared, and after a protracted hunt finds, let me say, such an old acquaintance as *Euchætes Collaris*, Fitch, disguised under the name of Cycnia Tenera, Hübner, and this without a word of explanation of this wonderful discovery, one can hardly be blamed for exclaiming "A plague on all your revisions."

In entomology, as no doubt in other branches of natural science, some men are lumpers and others are splitters. To the latter I would say that the describing of new species should certainly not be done on the chance of their proving distinct, and to the former that once a form has been described as a new species it should not be lumped except upon overwhelmning proof. As an example of most unwarrantable lumping may be instanced the case of *Euchætes Collaris*, Fitch, which on the authority of some wise-

acre was known for many years as "the common white variety of *Euchætes Egle*," because, forsooth, entomologists were too lazy or too stupid to secure the eggs and rear the species.

But I find a very curious tendency in many men to be both lumpers and splitters, lumpers in dealing with the work of others, but splitters in their own work.

A man takes up some group with the view of monographing it, gathers specimens from far and near, inspects all the types to which he can gain access, and finally announces that what have passed for half-a-dozen distinct species are merely slight local varieties of one world-pervading species.

Now this may be all right, though I think that such lumping might, perhaps, better be deferred till the forms in question had been brėd through all their stages. But look what follows: among the material gathered together he finds one specimen slightly different from any of the named forms, and two other specimens which agreeing together differ slightly in some other direction, and upon these three specimens two new species are founded, although the divergence does not appear to be greater than in the case of the forms which he has just lumped; and thus we have a patent lumper and splitter combined.

What I have already said of the difficulty, especially for amateurs, of keeping up with the literature of the subject leads me to suggest that it would be a great assistance if an annual list of all the new genera and species of North American insects, with the references as to where described, were published in the January number of the "Canadian Entomologist," and I feel sure that our journal would thereby become of greatly enhanced value to all working entomologists.

The insufficient indexing of some publications is a frequent source of vexation and loss of time, and adds materially to the difficulty of those who need to refer to articles some time after their publication. If the index of every journal were begun with the issue of the first number, each article being cross indexed as soon as issued, the work would not be heavy, and when the last number was in type a thoroughly satisfactory index could be completed in a very short time. The late Dr. Lintner placed a very high value upon a thoroughly complete index, and spared no pains to make the indexes of his Reports as perfect as it was possible to make them.

From 1868 to 1873 inclusive we had an Annual Record of American Entomology, edited by Dr. Packard, with a number of leading authorities in the different orders as associate editors. It was a very useful work, and it is, I think, much to be desired that we should have some sort of an annual index of American Entomology. The difficulties in its way are, I know, very great, but if it were possible for it to be undertaken by the Division of Entomology of the Department of Agriculture at Washington, it would be a great assistance to all the working entomologists of the continent.

Another point of great importance is the care of important collections, and especially the preservation and accessibility of types. It is not reasonable for any one to expect types to be lent for study as the risk of loss or damage is too great, but they should certainly be accessible to those who visit for this purpose the museums or private collections where these types are preserved. It is certainly disappointing when one has made an expensive journey for the purpose of examining a collection, or studying certain types, to find that one's journey is wholly or partly in vain, either through the caprice of a museum curator, or through the collection being in too crowded a condition to permit of an examination being made with safety.

To any one who augments his collection by either exchange or purchase, the different styles of pinning and spreading specimens of Lepidoptera are matters of serious concern, as one generally has to reset all specimens so obtained, unless one is willing to have one's specimens at all sorts of heights, and spread in all sorts of ways. The late Mr. Morrison, who collected so extensively for his patrons, used to insert his pins so that there was frequently very little more than a quarter of an inch above the thorax, and as he used very small sized pins, which bent easily, it was very difficult to handle the specimens without knocking off the antennae.

It was a great step in advance when all the principal makers of microscopes were induced to accept the Microscopical Society's screw, as any objective could be used on any stand. Is it too much to hope for, that entomologists on this continent should adopt a standard length of pin, and a standard height at which to place the specimen on the pin, a standard spreading board for Lepidoptera and a standard style of setting? And this brings me to the most important suggestion which I desire to make, and that is, that North American entomologists might with advantage follow the example of the ornithologists and form a "Union" with a limited number of full members, and an unlimited number of associate members, the full members to be chosen from the leading entomologists of the continent, but associate membership to be open to every entomologist.

The American Ornithologists' Union has been a marked success, and I see no reason why a similar union should not work equally well among entomologists. There are many subjects with which such a union might deal, and if its decisions were generally accepted, as I have no doubt they would be, I am sure it would do a great deal to harmonize the work in this branch of science.

To mention a very few of the things which might be dealt with in addition to those which I have already mentioned I may suggest the capitalization or otherwise of specific names, the nomenclature or numbering of the veins in the wings, the designation of the various segments of larvæ, as well as all the questions in regard to nomenclature. If it be objected that ornithology is practically one subject, while entomology is a whole collection of subjects, I answer, "True, but the same principles apply to all the branches." Take the case of the capitalizing or otherwise of specific names. Some capitalize all specific names, as Mr. W. H. Edwards, with whom on this point I entirely agree, others use capitals for names derived from persons and small letters in other cases; others, and I am afraid the large majority, use the lower case letter in all cases. Would it not, however, be better in such a matter as this to waive our personal predilections and for the sake of uniformity accept an authoritative ruling by such an organization as I have suggested.

With regard to venation the question of uniform designation is of much greater importance, as it is impossible for an amateur to familiarize himself with all the systems in vogue, and hence many generic descriptions or articles on structure are quite unintelligible to many readers. The old system of named veins and veinlets or nerves and nervures seems certainly preferable to me to the confused systems of numbering now in use by different authors, and surely this is a matter which could very profitably be settled by such a body, while in the realm of general nomenclature the field is so vast that the Union would have abundant material for business at its annual meetings for many years to come.

Another point in the same connection may be mentioned, and that is in regard to the official organ of such an association. There have been at different times so many different entomological journals started and carried on for a few years only to die out again. There are many entomologists who cannot afford to subscribe to more than one journal, and it might be better if instead of so many journals with small circulations competing for subscriptions there were fewer in the field, but those more generally subscribed to.

But lest I weary you with suggestions which may be regarded as savouring of presumption in an amateur, I would now invite your attention to a rapid glance at a portion of the work which is being carried on by some of the leading entomologists of the continent. While, as I said, I prefer to leave to others who are so infinitely better qualified the task of giving a review of the insect depredations of the year, I can hardly avoid referring somewhat briefly to some of those which have attracted the widest attention.

As Canadians we are naturally especially interested in the work which our own official entomologist is engaged in. Dr. Fletcher is certainly untiring in his work, travelling about the country from the Atlantic to the Pacific to attend meetings of farmers, fruit growers and dairymen, for the purpose of interesting and instructing them in the importance of economic entomology, and in regard to the economic value of particular grasses,

and the people are thus being brought to see that the aim of the experimental farms is not the providing of handsome residences in a charming locality for a certain number of scientific gentlemen, but that there is a very real money value to the agricultural interests of the country in the work and investigations which are being carried on there. But naturally from the large sums annually devoted by the Central Government at Washington and the various States to the prosecution of economic entomology by a large and highly trained force of entomologists, the work in that country must necessarily overshadow what we are doing in Canada, though I think it is also undoubtedly a fact that from our more northern latitude we are much less subject to insect depredations of a devastating character.

The attack which in recent years has caused the most widespread alarm on account of the serious nature of the damage likely to result from it is unquestionably that of the San José Scale. This most injurious insect appeared in California late in the seventies, was brought east on nursery stock to New Jersey in 1887 or 1888 and had by 1893, when its presence in the Eastern States was discovered by Dr. Howard, spread through portions of almost every one of the Eastern and Middle States causing the death of thousands of trees before its presence became known. Naturally it soon became a subject of discussion at all meetings of agriculturists and entomologists and has been the subject of legislation by sixteen of the States.

From this very necessary publicity it was naturally to be expected that other countries would take alarm and endeavor to protect their agricultural interests from so great a danger. The first country to do so was Germany, the German Emperor issuing a decree on the 5th February last prohibiting the importation of fruits and plants from America, which prohibition was subsequently restricted to living plants and fresh fruits which might be found to be affected by living scale.

Following shortly after the action of Germany came the passing by our Canadian Parliament of the San José Scale Act on the 18th March last, by which Act it was provided that nursery stock should be excluded when imported from such infected countries as might be designated by the Governor-General in Council, and the United States, Australia, Japan and the Hawaiian Islands were immediately so designated, the plants not subject to the attack of the Scale being exempted from the operation of the Act.

A month later the Government of Austria-Hungary issued a decree barring out living plants, grafts and layers, as well as the packings and coverings, but not excluding fruit except such as might upon examination be found to be infected. Following this the Government of the Netherlands sent an expert to the United States to investigate and report, and Sweden also sent an expert partly for the purpose of making a similar investigation.

The Legislature of Ontario has passed a law for the destruction of badly infested trees and providing reasonable compensation for loss so incurred, while in the United States a bill governing inter state commerce in nursery stock and providing for quarantine in the principal ports of the country was reported favourably upon by the Committee on Agriculture at the last session of Congress and will doubtless become law at an early date.

In this connection attention may be directed to the obvious limitations of the use of natural enemies of insect pests, the attempted introduction of Californian beetles into New Jersey in the hope of their multiplying and checking the San José scale having proved a failure, as has also the attempt to infect the scales with a parasitic fungus from Florida.

The present year has been an important periodical cicada year, the broods occurring this year being the brood XVII. of the Septendecim race and brood VII. of the Tredecim race. In this connection especial attention should be called to the very important pamphlet upon this subject prepared by Mr. C. L. Marlatt, First Assistant Entomologist at Washington, and issued as Bulletin No 14 of the new series of the U. S. Department of Agriculture. This paper extending to 148 pages copiously illustrated, is certainly the most

important contribution which has yet been made to our knowledge of this wonderful and interesting insect.

Last winter, the Legislature of Massachusetts appropriated $200,000.00, the full amount asked for, to continue the work of exterminating the Gypsy Moth, and as a consequence very remarkable progress has been made in this work during the past season, and it now seems probable that if similarly liberal appropriations are continued for several years longer this important, but tedious, work will be crowned with success. The work of destroying the Brown-tail Moth has also been intrusted to the same force and is being carried on in connection with the Gypsy Moth work.

Other work in Economic Entomology which may be referred to is the progress made by the Division of Entomology at Washington in the accumulation of data concerning the distribution of injurious insects in the United States.

Mr. Pergande, in furtherance of his investigations of the Lecanium scales affecting the fruit trees, spent the summer in Europe and collected large material.

In the early spring, Dr. Howard visited Mexico to investigate the possibilities of preventing the introduction of the Morelos Orange Fruit Worm into California.

Mr. R. A. Cooley, an assistant to Prof. Fernald, has been at work upon the genus Chionaspis and has accumulated an enormous amount of material, and it is anticipated that his paper, when published, will give more than twice the number of species formerly known.

Fig. A. Operation of the first category. A compound pupa and a compound moth of P. Cynthia.

But while the economic side of the science is that which is of chief interest and importance to the community, I confess that my own interests lie rather in the direction of the purely scientific side of the subject.

From this point of view the experiments of Mr. Henry E Crampton, Jr., of the Department of Zoology of Columbia University, are of surpassing interest.

Mr. Crampton, following up the experiments of Mr. G. Born upon frog and toad embryos, determined to try similar experiments in grafting upon Lepidoptera in the pupal period and has obtained some truly marvellous results Mr. Crampton selected the pupæ of the large Saturnians, Cynthia, Cecropia, Promethea and Polyphemus as being the most suitable, though he also experimented with success upon Vanessa Antiopa, but had no success in his operations upon Danais Archippus.

The butterflies are not so well suited to these experiments as these large moths, partly because of their status being higher than that of the moths, and in the case of those which winter either in the larval or imago state, the chrysalis period is too short.

Naturally, failure resulted in a good many cases, the average of successful operations amounting to about ten per. cent.

Fig. B. Operation of the second category. Union in "Tandem" of P. Cynthia, anterior, and C. Promethea' posterior.

The operations were of great variety, the anterior end of one pupa being joined to the posterior end of another either of the same or of a different species, or they were joined in tandems or in pairs back to back, while in one case the tip of the abdomen of one moth was grafted to the upper side of the abdomen of another. One pupa had had its head cut off and was still alive and the abdomens of some were cut off about the middle to see if any regeneration would take place. No cases have been successful where the division has been made longitudinally through the centre of the pupæ, and the nearer this line is approached the fewer there are which are successful, and conversely the less that is taken off the more likely are the subjects to survive.

The modus operandi is to slice the pupæ with a razor and effect the junctions with melted paraffin. The paraffin ring cannot be removed, as the coalescence is only effected between the interior portions, the two portions of the pupa case never uniting. The paraffin ring naturally tends to prevent the imagos emerging and they have to be helped out when they seem, from the papery condition of the pupa case, to be ready for emergence, the case being picked off bit by bit.

In general, the wings fail to expand and as a consequence the abdomen remains distended by the hæmolymph. In some cases the wings, or a majority of them, expand very well, one, perhaps, being aborted. In the case of a tandem junction, the anterior one may expand and the posterior one not. In such a case the former had only lost the tip of its abdomen, while the lower one had lost its head. In one case where two portions of pupæ were joined laterally, one eye in one part had coalesced with the neighbouring one in the other part to form a common eye. As a rule, the operations greatly retarded the development of the specimens.

Fig. C. Operation of the third category. United pupæ and united imagines of S. Cecropia.

One of the objects of these experiments was to see what effect, if any, the unions would have on the colours of the resulting moths, but the results were rather negative, as nothing very definite was obtained.

ig. D. Operation of the third category. United pupæ and united imagines of S. Cecropia

Another object was to ascertain if it would be possible to breed from such monstrosities, but though some individuals had shown symptoms of desiring sexual connection, no union had ever taken place, and so no eggs had been obtained, and as these operations must greatly lower the vitality of the subjects, it seems very improbable that any attempts at breeding from these monstrosities could ever be successful*.

Another man who is doing good work, though in a much less startling field, is Dr. Otto Seifert of New York, in his experiments with heat and cold applied to the pupæ of butterflies and moths. Following up the work of Dorfmeister, Weismann, Edwards, Stange, Merrifield, Standfuss, and Eimer he has made extensive experiments upon a considerable number of species.

Pyrameis Atalanta, which seems very susceptible to these influences, Papilio Asterias, P. Turnus, Colias Philodice, Grapta Interrogationis, Melitæa Phaeton, Danais Archippus, Limenitis Disippus, Vanessa Antiopa, Junonia Coenia, Arctia Arge, A. Nais, Philosamia Cynthia, and Samia Cecropia have all been experimented upon with more or less success.

The operations were carried on by means of an incubator and an ice chest, the temperature in the former being maintained as nearly as possible at 38° C. equal to 100° F. while in the latter it varied between 4° C. and 6° C. equal to 39° F. and 43° F.

In summarizing his results Dr. Seifert informs me that the effect seemed to depend more upon the susceptibility of the individual than upon the length of the exposure to these artificial conditions, as in some cases chrysalides kept ten days on ice produced more aberrant forms than resulted from others kept for thirty days on ice.

Cold and heat did not always have opposite effects in some particulars, as for instance Limenitis Disippus exposed to heat was deepened in colour along the costa to the middle of the wing, the mesial band of secondaries narrowing or being omitted altogether. Subjected to cold the colour was turned darker also but in a different way, the darker tone being chiefly produced by many black scales along the veins, and the mesial band on secondaries being more marked.

While heat in general tends to produce a more marked or defined design, when accompanied by an excess of moisture Dr. Seifert found a tendency to almost destroy the colour but never to affect the design.

Heat and cold were also found to affect the shape of the wings, in some cases the apex of primaries becoming more pointed, while in P. Turnus and G. Interrogationis cold caused a remarkable development of the scallops and dentations of the wings.

Cold changed the rounded secondaries of Junonia Coenia to a form more elongated towards the anal angle, while heat shapes the wings of Limenitis Disippus nearly to those of Danais Archippus.

Pyrameis Atalanta was affected in the most interesting manner by cold, the red transverse band on primaries above being broken up into four spots while below the secondaries are much changed in appearance, the buff tone of the lower two-thirds of the outer margin being greatly strengthened and spread inwards, while a violet bloom tends to spread over the wing.

In Arctia Arge the prominent black spots on the abdomen vanish entirely or are much diminished by heat, and the black marks on primaries are also reduced.

By cold the black spots on the abdomen are enlarged, sometimes in the female becoming transverse bands, while on the secondaries blackish streaks originating from the base spread outwards towards the margin.

Dr. Seifert also experimented upon eggs but could only find that heat hastened development while cold retarded it. Eggs of Colias Philodice exposed to a temperature of

*The cuts illustrative of these experiments have been copied from those in "Biological Lectures," published by Messrs. Ginn & Co., of Boston, by the kind permission of Mr. Crampton, who delivered the 11th lecture at the Marine Biological Laboratory of Wood's Holl in the summer session of 1897.

100° F. hatched in 36 hours, while cold if not carried too far, 8-10 days, merely retarded the hatching, but eggs of A. Luna exposed to cold for 20 days were all killed.

The chief point which Dr. Seifert is seeking to elucidate is whether the variations obtained can be transmitted to the offspring and become hereditary. This field of investigation, while much less startling than that in which Mr. Crampton is working, certainly seems likely to prove more fruitful.

Among the most important publications on the Lepidoptera of North America which have appeared during the year must be mentioned Prof. Fernald's monograph of the Pterophoridæ, with its sixty-two pages of text and nine plates devoted altogether to structural details, which work has been accorded the highest praise by those best able to judge of its merits.

Mr. Beutenmüller has laid us under a further debt of gratitude by the issue of his "Descriptive Catalogue of the Bombycine Moths found within Fifty Miles of New York City," which appeared last month. This is on the same plan as his previous catalogues of Butterflies and Sphingidæ, and extends to ninety-six pages, with nine excellent plates. One hundred and eighty-one species are described, of which ninety-three are illustrated, but from lack of space the author had to omit all generic descriptions. At present this work is only available to those having access to the "Bulletin of the Amerian Museum of Natural History," or are so fortunate as to receive a copy of the author's edition, but I am glad to be able to announce that Mr. Beutenmüller, on completion of the series, contemplates re-issuing the whole in book form, which will then be generally available.

Mr. Beutenmüller, in addition to carrying on this important work, is also engaged upon studying various genera of the Lepidoptera with a view to revision, and has recently issued a review of the genus Euchloë or Anthocharis, to be followed later by a paper on Argynnis.

Dr. Dyar has been carrying on his important studies on structure, especially of larvæ, and is engaged in conjunction with Dr. J. B Smith upon a monograph of Acronycta, and is also at work upon a new catalogue or check list which, it is promised, will render the Lepidoptera scarcely recognizable by those who have accustomed themselves to Dr. Smith's Check List of 1891.

Dr Ottolengui of New York has taken up the Plusia group and has gathered specimens of nearly, if not quite, all the known North American forms, and has secured either specimens closely agreeing with all types which he has not been able to see or, where this was impossible, carefully executed colored figures of such types. He is thus in a position to monograph the group, and has discovered some extraordinary errors which have been current for many years. If I may be pardoned for saying so, his work has been carried on on precisely similar lines to my study of the Callimorphas some years ago, namely, by finding out first what each author meant by his description, fixing the types absolutely, and then working from that basis, instead of taking things for granted and going by guesswork, and this, I contend, is the only true method.

In Coleoptera, as I am informed, the illness and death of Dr. Horn has produced almost a standstill.

In Hymenoptera valuable contributions have been made chiefly by Mr. Ashmead, aided by Dr. Howard, Mr. Marlatt and Dr. Dyar, the latter in Tenthrenid larvæ, and the growth of knowledge in this order has been almost phenomenal, while Dr. Smith has been engaged in most interesting work on the underground forms, the Digging Bees, by means of the plaster cast method.

In Diptera the works of Messrs, Coquillett and Johnson, especially the very important "Revision of the Tachinidæ" by the former, have added much to our knowledge, and it is encouraging to note the increase in the number of students in this order.

In Orthoptera the event of chief interest has been the issue of Dr. Scudder's most important "Revision of the Melanopli," a work which must have involved an immense amount of labor and research, extending as it does to over 400 pages, and illustrated by

twenty-six plates. In connection with this order attention may be called to the interesting discovery that the large Mantid, Tenodera Sinensis, Saussure, from China and Japan, has been introduced into the United States and has been breeding for at least three years in the vicinity of Philadelphia.

In regard to Hemiptera, I have already referred at some length to the San José Scale and the work in connection therewith, but mention should also be made of Prof. Cockerell's pamphlet on the other scale insects closely allied to the San José Scale and liable to be confounded with it.

The completion early last year of Mr. W. H. Edwards's magnificent work on the Butterflies of North America, which was undertaken in 1868, caused something like a pang to those who for so many years had been receiving as they appeared the successive parts of this splendid work, and the hope has been expressed on many sides that the talented author might be willing to undertake the issue of a supplementary volume of, say, twenty-five plates, for which he has ample materials, provided one hundred subscribers at $1.00 per plate could be secured.

But if the closing of Mr. Edwards's labors produced a temporary lull in the issue of beautiful illustrations of our North American butterflies, we are now about to see issued a work which is surely destined to popularize the study of the Lepidoptera on this continent if anything can.

Dr. Holland, the talented Chancellor of the Western University of Pennsylvania, who has amassed an enormous collection of Lepidoptera, including that of Mr. Edwards with all that author's types, has undertaken the publication of a large edition of a popular book on the North American butterflies, to be called "The Butterfly Book, A Popular Guide to a Knowledge of the Butterflies of North America," and has authorized me to make the following announcement in regard to it:

It will be brought out, probably about the end of November, by the Doubleday & McClure Co. of New York,* and will be illustrated by forty-eight coloured plates done by the same system of photographic reproduction and printing which has become so familiar through the publication on Birds issued monthly by the Nature Study Publishing Co. of Chicago and New York. These plates will represent 526 species of diurnal lepidoptera, in many cases giving both the upper and under sides of the insect. The figures are, in the main, taken from the type specimens contained in the Edwards collection, and many of the species are represented for the first time, having never previously been figured. In addition to the representations given of the imago, Dr. Scudder has most kindly granted permission to reproduce the plates contained in his Butterflies of New England in which the early stages of these insects are represented. There are, furthermore, to be about 200 cuts in the text, representing anatomical details of structure which are useful in the determination of genera. A cut representing the neuration of each genus is given, and in some cases additional cuts showing the subgeneric forms. Brief descriptions of the imago, egg, caterpillar and chrysalis, when the latter are known, are given in the text. Interlarded in the somewhat dry technical details are extracts from the writings of other authors, which are calculated to interest the general reader, and quotations amusing and pathetic, gathered from out of the mass of butterfly lore.

All this is to be put before the American and Canadian public in good binding for the sum of $3.00, but it will be necessary to sell 7,000 copies of the book, unless a monetary loss is to result, but surely among the 70,000,000 of the United States and the 5,000,000 of Canada there should be no difficulty in disposing of 7,000 copies of such a book at such a price.

A fair idea of the character of the plates can be obtained from the rough proofs which Dr. Holland has sent to be shown at this meeting.

* A Canadian edition has been published by Mr. William Briggs, 29-33 Richmond St. West, Toronto.

In regard to the publication "Birds," which title has recently been enlarged to "Birds and all Nature," and which has begun giving excellent illustrations of butterflies and mammals in addition to the plates of birds, it seems a great pity that with such beautiful plates it is not considered worth while attempting to make the text of some scientific value.

Another popular book under the name of "Every-Day Butterflies," from the facile pen of Dr. Scudder, is announced and will contain familiar and fully illustrated accounts of sixty or more of the commonest butterflies, taken in the order of the season.

In conclusion I have to express my indebtedness to Dr. Howard, Dr. Smith and Prof. Fernald for the kind manner in which they responded to my inquiries, and for the valuable information afforded and suggestions offered, which have materially contributed to any interest which my address may possess, and to you, gentlemen, my acknowledgments are due for the patience with which you have listened to me.

Dr. Fyles, in rising to move a vote of thanks to the President for his valuable and interesting paper, said that he approved of the address with one exception namely, that when so good a worker, so good a collector, read so good a paper as the address just given, he should not call himself an amateur. Dr. Wm. Saunders seconded the motion He had listened with great pleasure to the address, so full of admirable suggestions showing the keenest interest and deep insight into the needs of the active entomologist. He called attention to the many interesting statements of the investigation now progressing. *Carried.*

Mr. Lyman briefly acknowledged the vote, saying that as he was not a professional entomologist he must be an amateur.

Mr. W. E. Saunders, referred to the President's suggestion of the formation of an American Entomologists' Union, and spoke of the good work done by the American Ornithologists' Union, in preventing needless changes of nomenclature and in other important matters. Mr. A. E. Norris spoke on the importance of uniformity of setting, strongly approving the President's suggestion of a Union to authoritatively settle all such matters. He would favor the giving of greater attention by the societies to the working out and making complete exhibitions of the life histories of insects, as such exhibits are at once the most interesting and instructive.

A paper entitled "Some International features of Economic Entomology" by Prof. F. M. Webster, Wooster, Ohio, was then read by Dr. Fletcher.

SOME ECONOMIC FEATUES OF INTERNATIONAL ENTOMOLOGY.

By F. M. Webster.

When that massive ridge of Archæan rock, the backbone, so to speak, of the future American continent, was first laid down, stretching away from northwest to southeast, it is hardly to be supposed that it was cut in twain from east to west by some huge chasm, which, in future ages, was to separate from each other two distinct worlds of animal life, with no inter-communication between them.

Nor is it more likely that, after the ponderous ice sheets of the Glacial Period had plowed their way from the far north, crushing and grinding the solid rock and transporting huge boulders from the area that we are now pleased to term Canada, far to the southward, and depositing them along what is now the Ohio River, there should have been thrown athwart this pathway an invisible barrier across which animal life could not by any possibility make its way.

It was nature that hollowed out the beds of the great, turbulent lakes and furrowed out the course of gigantic Niagara, but it was uncivilized man who first chose to make these barriers between himself and his enemies ; and while civilized man has followed the

example thus set for him, this is no part of nature's handiwork. Though the Cross of St. George may now proudly float from the one side, and the Stars and Stripes as proudly respond to the northern breezes from the other side; though there may be martialled, armed hosts on either side, the coats of one being red and the other blue, this is but following in the footsteps of the uncivilized aborigine, and not in the pathway of nature.

The feathered migrants of the air will, each recurring spring, make their way from the far south and rear their young in your woods and fields and along your inland lakes and streams, gathering their progeny together and making their way southward again in autumn, though a Queen might issue her edicts and a President promulgate his orders to the contrary. Again, the finny tribes of the sea and lakes seek their food and deposit their spawn wherever their inclinations and a favorable situation may tempt them, wholly unconscious of the tribulations that they bring upon the enthusiastic angler from the cities of the United States, who suddenly finds himself and his craft in the hands of British law in case he attempts to follow them. The moose, the wild deer, the wolf and the bear are no less free to go and come, roving northward or southward as their inclinations prompt them, totally ignorant of the terrors lurking in invisible, arbitrary lines and the questionings of custom house officers; for these are the belongings of men and not of nature.

In the light of what has been stated, then, it may be said that at present Canada and the United States are separated by an imaginary, arbitrary, political line, which we as subjects of two powerful nations are bound to respect in matters outside of natural science, but it seems to me that the naturalist must be permitted to demand that this condition is not allowed to extend farther. We are dealing with nature, and nature, as has been shown, knows no national lines. With us, as entomologists, the fact that we are all Americans must stand paramount to any other considerations. America is separated more or less widely from other portions of the world by depths of sea, which form a far more effective barrier to insect migrations than any that human minds can conceive or human hands erect. Unaided by man or his agents, but few insects could make their way from the eastern to the western hemisphere, or vice versa, though those neo-tropical might and probably have, unaided by man, spread from thence northward into the nearctic regions. Two illustrations of these last will suffice, one the Harlequin Cabbage Bug, *Murgantia histrionica* (Fig. 1), known to inhabit Central America and the West Indies, has lately pushed its way northward, in Ohio, to within twenty miles of Lake Erie, or to about Lat. 30° 15′ N., while the Chinch Bug, *Blissus leucopterus* (Fig. 2, highly magnified), in all probability originally a neo-tropical species, has, as you know, spread northward over a portion of the Dominion of Canada, and while it has not as yet been known to depredate upon your crops to any noticeable degree, yet it may do so in the future, in which case it may be expected to first make its presence known in your timothy meadows rather than in your grain fields, and quite likely will work considerable injury before it is recognized by your agriculturists. Another phase of this problem of insect migration is illustrated by the Colorado Potato Beetle, *Doryphora decemlineata*, which at one time was restricted to the country about the base of the Rocky Mountains, and its food-plant consisted of vegetation having no economic value. But now came the eastern emigrant farmer with his indispensable potato, a plant closely allied to the natural food-plant of this insect, and thus the potato patches of the settlers became as so many stepping-stones to the beetles and enabled them to make their way eastward to the Atlantic coast and Canada, transcontinental railways probably hastening their arrival, as they are shown to have appeared along the lines of railways earlier than elsewhere. So much for this aspect of the problem, but let us now turn our attention toward some other phases of a more international character.


Fig. 1.


Fig. 2.

Many years ago, probably about 1856 or 1857, the Cabbage Butterfly, *Pieris rapæ* (Fig. 3), was introduced about Quebec, and possibly also again about 1891, since which time it has spread westward and southward until it now extends from the Atlantic to the Pacific and nearly to the Gulf of Mexico, even its numerous parasites not being able to entirely prevent its ravages. The Codling Moth, *Carpocapsa pomonella*, was in all probability first introduced into the United States, but Canada has as you all know sustained her full share of injury from its ravages. These two species have been brought to our shores from the mother country, and they are by no means the only ones that have been introduced from Europe or Palæarctic regions, and, I fear, those that we now have with us will not be the last to come this way. The latest and most serious introduction of all, the San Jose scale, *Aspidiotus perniciosus*, is in all probability another contribution from the Palæarctic region, as I have been able to prove almost conclusively that it came to us from Japan, and we therefore received it from the west instead of the east. Recent experiences are amply sufficient to show that it will destroy the orchards of Canada as well as those of the United States, within whose domains it first made its unwelcome appearance.

Fig. 3.

The foregoing illustrations will certainly be sufficient to convince anyone that we cannot by simple Legislative or Parliamentary enactment erect a Chinese wall, so to speak, that shall keep Canadian insects, whether native or introduced from making their way into the United States, or similar species escaping from the latter into Canada. We in the United States are more likely to import more insect pests than you, and, owing to our geographical situation, will suffer most from their depredations, but, put the matter as we will, we are much in the position of a large family threatened with an attack of some contagious disease; if one member contracts it all will be alike exposed, and to attempt prevention by individual isolation, will result in no end of trouble and aggravation without accomplishing the end desired, precisely as we have found our State laws to do. What we need, primarily, is an international quarantine measure that shall apply uniformly to all North America. A judicious, properly enforced measure that shall mean the same from the mouth of the St. Lawrence to the mouth of the Rio Grande, and from there to Vancouver or the mouth of the Yukon, and as far beyond as is found necessary. It is all very well for your Canadian law-makers to say that it is none of Canada's affair what is done in the United States, and our politicians will make the same plea, but we who are continually dealing with these problems of nature know better! We know that there is a power higher than that of our combined nations, that rules these natural elements, which power we cannot control, but, may oft'times utilize to our advantage. International entomology and international insect legislation are matters that we are being confronted with for the first time—matters of the future rather than of the past—but the next century will see them brought to the front. There will arise important questions which must be settled calmly, judiciously and justly, and entomologists must be ready to advise and counsel in these matters. The Entomological Society of Ontario ought and will have its influence in solving these international problems, as these come up one after another for solution and in accordance with nature's unyielding laws. I look for the time to come, and in the comparatively near future, when these matters will become far more important factors in international law than they are at present, as, indeed it seems impossible that the situation can be otherwise.

If we look about over the world at the present time, we find Cape Colony prohibiting the importation of all American nursery stock, whether from the United States or Canada. Several European nations have gone even farther and attempted to prohibit American green fruits from being brought within their respective domains. Queensland quarantines against New Zealand, South Australia against New South Wales, and Tasmanian fruit is condemned and destroyed in Melbourne; British Columbia destroys infested fruit from the United States as well as from other parts of British America, while

Canada prohibits the importation of nursery stock from the United States; at the same time several of these States have enacted laws which enforced to the letter would become quite prohibitory in their effects. The most of this trouble has come from the appearance of that pernicious little pest the San Jose Scale, *Aspidiotus perniciosus*, which we, in all probability, first received from the west.

Now, this method of dealing with the problem of insect control cannot be said to be all wrong, as some of it is quite necessary and proper, but there is certainly a great deal of misdirected effort being put forth and commerce is suffering therefrom to a considerable extent. It is the beginning of insect legislation, and first attempts at anything are usually more or less crude and capable of improvement. It is all right for Cape Colony to protect her growing fruit interests by keeping certain fruit pests out of South Africa, by prohibiting the importation of nursery stock, liable to infection, and keeping these Acts in force until such time as the pests have either become exterminated or some method discovered whereby the nursery stock can be effectually disinfected and rendered safe. If the Australasian Colonies had, years ago, united on a uniform code that would apply to all ports alike and admitted nursery stock and green fruits after an examination and disinfection, as has been done at the port of San Francisco, California, during the last few years, they would not now be contending against each other. If we in America had taken similar steps in the matter of insect legislation fifty years ago, we would in all probability have escaped much of the insect depredations of the present, as the major part of our seriously injurious species in this country are of foreign origin.

It is of course, too late, now, to prevent what has already been done, but it is not too late to take measures to prevent further importations from both east and west. In our efforts to suppress the insect pests that we already have with us, we are overlooking the greater problem of prevention of future similar introductions. We are laying altogether too much stress upon individual effort, as put forth by States, Colonies or Provinces against each other, and entirely losing sight of the international aspects of the problem. We cannot seem to diabuse our minds of the idea that political lines have something to do with the management of these natural organisms, and cannot apparently grasp the idea that natural barriers may be utilized by one or more nations acting in unity, and for the direct benefit of all thus acting. Sometime in the future, though neither you nor I may live to see it come to pass, these arbitrary, imaginary lines will, in problems of this sort, be lost sight of, and there will appear in their stead lines of another sort, far less imaginary and more natural, and these will encompass not one nation alone, but one or many as the case may be. We shall then designate these areas by a term now unknown, except to scientific ears, viz., Zoogeographical Regions, and while these may vary somewhat from the outlines laid down by Wallace, in his "Geographical Distribution of Animals," yet they will probably cover much the same areas as there indicated. There will probably continue to occur cases like that of the Colorado Potato Beetle, where a species may spread from one section of a Zoogeographical Region over, and become destructive in, many portions of the remainder, yet these phenomena are likely to occur but rarely. We may learn that the Almighty can make a better barrier, over or around which insects cannot make their way, than the wisest of men or the mightiest of nations. There are phenomena connected with the geographical distribution of insects for which we cannot, with our present knowledge, account. There are boundaries beyond which certain species do not make their way, though to the human eye and mind there are no obstructions in the way of their doing so. The science of applied entomology is yet in its infancy, and we have very much to learn even of our most common species of insects, but we can even now see the unnatural and impractical methods that we are trying to apply toward their control, as between one portion of the world and another. We try to erect legal barriers where none exist in nature, and ignore those which nature has provided. All of this, of course, applies to protection from future importations, and not to such as have already gained a foothold, these last being beyond the scope of my paper, as I have restricted it, and the management of these will depend largely upon the energy and care of the people inhabiting the territory over which such species are now distributed. There is, however, a very important phase of the problem of controlling these pests,

already imported from foreign countries, and which will be discussed later on in my paper. While it has not been deemed best to discuss, in detail, legislative control of such destructive species as have already been colonized here in this country, and many of them widely diffused, yet their possible control in many cases at least, by the application of nature's own forces seems to me to constitute a very important feature of International Entomology.

Forms of both plants and animals, unaided by the influences of man, make their way over the face of the earth but slowly if at all, and it is probable that a species often becomes so influenced by the change that it loses its specific identity and takes on new characters, so that the specialist rechristens it and gives it another name. The result of all of this is that wherever a species makes its way, naturally, its enemies usually follow, or else while undergoing the process of adaptation, new enemies come to exert their influence. In other words, the difference between an artificial and a natural introduction is much the same as suddenly dumping an iceberg into a pond, as against allowing the same amount of water to make its way into the pond, from the same source, but through a small spring or brook. In the former case both equilibrium and temperature are disarranged, while in the latter the effect is too gradual to cause any radical changes.

The legitimate introduction of plant life from one country into another has come to be a matter of vast commercial importance, and, adding as it does to our health, comfort and pleasure, such introductions are in every way commendable. Accidental introductions may, however, not always prove so satisfactory. Now, all of this brings me to the second phase of the subject of International Entomology, viz., the intentional, if not indeed necessary, introduction of exotic insects in order to re-establish the equilibrium that has been upset by the importation of plant life, or, as is sometimes the case, to enable the plant introduced to become permanently established.

Of species of insects purposely introduced from one country into another, there are those whose products constitute articles of commerce, of which the honey bee and silk worm are well known illustrations. The importation of large quantities of the ova and imagines of two species of American aquatic hemiptera, *Corixa mercenaria*, Say, and *Notonecta americana*, Fabr., from Mexico, where they are used for human food, into England, where they are to be used as food for birds, game, fish, etc., is another illustration of a different feature of this commerce in insect life.

The relations of insect to plant life are, however, so various and intimate; and, because of their reaching out over the face of the globe for the fruits, grains and ornamental vegetation of other climes, men are finding themselves more and more driven to import insects foreign to their respective countries. In some instances it has been found impossible to permanently establish an exotic plant without insect assistance. We all remember how impossible it was to get the red clover plant established in New Zealand until humble bees were also imported to fertilize the bloom, as the plant is not one that will perpetuate itself indefinitely from the roots; and at present we in the United States are unable to grow the perfect Smyrna fig owing to a lack of the good offices of a little foreign insect, *Blastophaga pensens*, which actually represents the male element in its fertilization.

Lastly, we come to what appears to be the most important of all insect importations, viz, the introduction of foreign, carnivorous insects, whose office in their native country is to prey upon and destroy those that are destructive, which last we have unintentionally imported into this country on trees, plants and shrubs, or in the fruits and grains coming to us from these same countries. That is to say, when we find that we have introduced a destructive species of insect, we are to go to the native habitat of this and there secure its native insect enemies, and introduce these to hold the former in check, as they do at home.

Parasitism is nature's insecticide—one of the forces that is employed by nature to restore equilibrium, so to speak, among natural organisms in point of numerical strength. The observing entomologist may every year witness proof of this, for he will observe some species to increase very rapidly during a short time, and, knowing of their fecundity, will

often be led to predict a serious outbreak. But at the opportune moment, Presto! a change! and the species that was but yesterday, as it were, literally swarming, is now reduced to a minimum, while the dead are everywhere thickly scattered about. Two instances of this sort have, the present year, come under my own observation. Early in May, the females of the grain aphis, *Siphonophora avenœ*, appeared on the growing wheat and were soon surrounded by their young. These insects were in a short time as plentiful as they usually are, at that season, in years of excessive abundance, and there seemed every indication of an outbreak of the pest. But now there appeared a little Braconid parasite, *Aphidius avenaphis*, and within ten days there were few living adults to be found, though the distended, brown bodies of those that had succumbed to their minute enemy were everywhere plentiful. It was as if a Mighty hand had been stretched forth accompanied by the command, Peace! be still. During August and early September there were great numbers of caterpillars of *Spilosoma virginica* (Fig. 4, *a* caterpillar, *b* chrysalis, *c* moth) and to a less degree of *Arctia acrœa*, in Northern Ohio, and, if they had all developed moths, there would have been much injury caused by the caterpillars next year. But this was not to be, as by September 20th the dead and dying were hanging to weeds, grass and fences, in myriads, having been attacked and killed by a fungous enemy, probably *Empusa aulicœ*, Reich., and neither of these caterpillars will probably be at all abundant with us next year. The same phenomenon was noticed in Ohio six years ago.

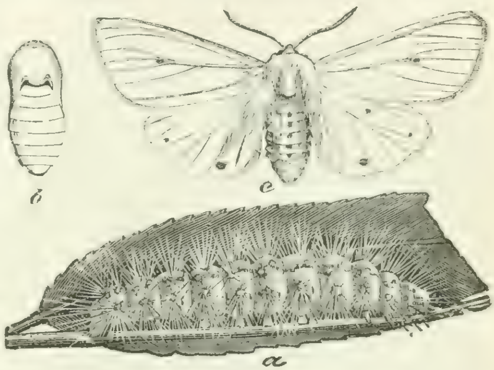


Fig. 4.

Scattered through our entomological literature, are hundreds of such illustrations of the value of parasites in holding in check tne hordes of destructive insects that occur in this country, and there is hardly a working entomologist who cannot add to these from his own unpublished notes.

Of our most destructive insect pests nearly all have been brought to this country from abroad. Lack of their natural enemies here, together with the fact that, in many cases, these introduced pests are not known as such in their native homes, leads us to conclude that we, in our importations, have left these enemies behind. The case is much as though we were to import from some foreign country a huge piece of machinery, but on its arrival we find that the balance wheel has been omitted, and in such a case what are we to do? Cable back for the missing wheel, or attempt to run our machine without a balance wheel? There are, doubtless, instances where introduced species can not be subdued in this manner, by the importation of their ancient enemies, but, generally speaking, this appears to be the rational method of accomplishing this end. The history of the introduction of the Orange Scale, *Icerya Purchasi* (Fig. 5), from Australia into California, is probably familiar to most, if not all, of those present. The orange industry of the United States and, as was afterwards learned, of other countries also, was threatened with a most destructive enemy to citrus fruits. In California orange groves were being destroyed to such an extent that it looked as though the cultivation of this fruit would have to be abandoned. But a natural enemy of this pest was discovered in Australia and imported, artificially, into this country, and as a result the pest has been subdued, and with us, before it had spread beyond the Pacific coast. Not only this, but

Fig. 5.

this natural enemy, one of the Coccinellidæ, has been sent wherever the Orange Scale has been introduced and the effect has been the same as in this country. All of this has been an object lesson in the application of Nature's forces in overcoming the evil results of man's influences in the artificial diffusion of destructive insects. In North America, and also in Australasia, men are at present wrestling with another important pest, allied to the Orange Scale, and introduced into California many years ago, but in this case probably from Japan. I refer again to the San José Scale, *Aspidiotus perniciosus*, which has, with us, spread over a vast range of country and already caused great losses. From all that I have been able to learn by observation of this pest, both in the orchards of the United States and on nursery stock immediately on its arrival from Japan, and also from the writings of others, it would appear that the natural enemies of this pest have been left in their native homes. Probably, as with the Orange Scale, these are Coccinellids whose habits are such that it would be impossible to get them in connection with their hosts at the time when the trees are packed for shipment to this country, as this is done at the season of the year when these insects have finished their development and abandoned the trees, if not wholly, remaining only in the adult state and would promptly desert the trees on being disturbed. If there had been important internal or fungous enemies we should certainly have gotten these with the host insect long ago. Now, it would certainly seem that in the introduction of Aspidiotus and its suppression we have a problem in applied international entomology, precisely like that presented by Icerya, and it would as certainly appear that, with our past experience, the very course of all others to pursue would be to learn what the natural enemies of this insect are in its native home and then introduce these as promptly and diffuse them as widely as possible, not only in one state or province, not in the United States or British America alone, but in North America * It is Americans that are suffering from the ravages of this pest, where they are located, geographically or politically, does not matter in the least. International boundary lines cut no figure in this problem whatever, and have no more influence on these natural objects than they have on the winds. We should seek to introduce living organisms from the Palæarctic Life Region into the Nearctic Life Region, no matter what or how many nations may lay claim to the territory of either one or both of these regions. What we are really trying to do is to help natural selection to keep pace with artificial selection, and, if we accomplish anything in this direction, it will be by aiding nature and not in any sense by attempting to circumscribe her by imaginary lines of separation which have no existence in fact.

Now, lest I be misunderstood, let me say that true naturalists can only exist among loyal men and women. We must, all of us, be true to the nation that protects us by its wise and judicious legislation. Science stands for truth and right and honesty, and, for this very reason we must stop whenever and wherever these national lines cease to represent the truth, and be guided by others. In matters political, we must respect political lines, but in dealing with natural phenomena, we must abandon these and be guided by such as have been laid down by the hand of the Creator, who outranks either Queen, President or any other human potentate, Therefore, we must lose sight of national boundary lines and unite upon those laid down by nature. Here, in North America, there should be the closest relations between the United States Department of Agriculture and similar Departments of the various Provinces of British America, and absolute unity of action wherever this is possible. This quarantining of one State, Province or Nation against another may possibly do in cases of isolation, like New Zealand or Cuba, or as applied to some of the ills that we already have with us, but this sort of work will never protect in the sense that a combination certainly would, if we were to throw aside

*NOTE—Since the above was written I have received the following from the Rev. H. Loomis, of Yokohama, Japan, which will be of interest in connection with this paper. "I see in the *Canadian Entomologist*, for July, an article in which you recommend that some one be sent to Japan to make a study of the enemies of the San José Scale. I think it a most excellent suggestion. There are many varieties of Lady Beetles here, and I am quite sure that it is due to them that the Scale is not more injurious in Japan. I am strengthened in this opinion because the Gypsy Moth is found all over Japan, and yet it is not especially harmful. This is entirely due to a parasite that feeds upon the larvæ so universally as to prevent its rapid increase. I have watched the results with great interest and would recommend that both insects be made a matter of careful study."

arbitrary lines and unite on others laid down by nature. This is a phase of international entomology that will sooner or later be thrust upon us by the necessities of international commerce in articles that harbor injurious insects. We must have broader measures of protection than we have had in the past. We must take necessary precautions against the introduction of injurious species, and, after the most thorough and searching investigations, introduce the beneficial species. In all of these matters, Canada and the United States are one, and, this being true, there must be no lines of separation between the entomologists of these two countries. We must work together, shoulder to shoulder, and God speed the day when we shall do this, to even a greater degree that we are now doing! The coming century will be fraught with work for the entomologist, and his loyalty to his country will be best shown by his careful, conscientious labors.

On concluding the reading of this paper Dr. Fletcher said that he thought it was one of unusual importance and particularly so just at the present time when such great efforts were being made to prevent the spread of the San Jose Scale, a danger the magnitude of which was by no means appreciated by the fruit growers and fruit consumers of the Dominion. It was, too, eminently proper that the subject should be introduced by the writer of the pages which he had had the honour of reading to the meeting, for few people had done so much to present the subject to the public of America as Prof. Webster. It was well pointed out that the political limits of the two great countries mentioned were not recognized by the natural denizens of the faunal and floral zones which we had as naturalists to study, although by accident owing to the great lakes this was somewhat the case. International economic entomology was only in its infancy, but it was being rapidly acknowledged at its right value of importance owing to the vast interests at stake. Dr. Howard, in his letter regretting that he could not be with us to-day, had been good enough to say that he considered the relations existing between the entomologists of the Dominion and of the United States to be of an ideal nature. The speaker felt sure that all present would agree with him that this was actually the case, and further, that this happy state of affairs was largely due to the constant and unfailing courtesy of Dr. Howard himself and his assistants at Washington, too numerous to mention now by name separately, but well known to every student who required help with regard to any special family of insects; to such men as the late Drs. Riley and Lintner, to Professors Webster, J. B. Smith, Comstock, Slingerland, Hopkins, Alwood, Johnson, Cockerell, Fernald, and many, many others who were not only always ready to help, but had in the past frequently helped with most valuable papers published in our reports and in the *Canadian Entomologist.* In his official position he was brought frequently into contact with these gentlemen and found invariably the utmost kindness and ready assistance. Last spring he had by invitation taken part in a conference of economic entomologists, fruit growers and nursery men held at Washington, for the purpose of laying before Congress the advisability of passing legislation for the suppression of the San Jose Scale. A committee waited upon the Congressional Agricultural Committee and explained the wishes of the conference and a favourable report was made by the Agricultural Committee to Congress. Legislation would undoubtedly have been enacted almost identical with our federal San Jose Scale Act but for the unfortunate outbreak of the Spanish-American War—Canada however had done her part and Dr. Fletcher believed that this law was a most useful provision. The Minister of Agriculture had considered the matter most carefully and the present popular measure was due to the minister's careful enquiries and legislative skill. The Hon. John Dryden had also put forth strenuous efforts for the protection of the fruit interests of the Province of Ontario. Too much could not be said of the excellent work of Mr. W. M. Orr the Superintendent of Spraying and of Mr. G. E. Fisher who had pushed most energetically and tactfully the inspection of orchards for the San Jose Scale.

Dr. Fletcher congratulated the members of the Montreal Branch on the splendid work they were doing; he paid a well merited tribute to the persistent work which Mr. Lyman the president had been doing during many years and characterized the many papers which had appeared from his pen as being prepared with the greatest care as to detail, complete-

ness as to research, and richness as to scientific facts they contained; his example had done much to stimulate the other members of the Branch to continue the good work they were doing for the Science of Entomology, particular attention being drawn to some of the collections exhibited at the present meeting, as those of Mr. Dwight Brainerd, who had prepared some beautiful cases illustrating the life-histories of several species of insects, of Mr. A. F. Winn, Mr. Dunlop, Mr. Williams and Mr. Norris, all of which contained many specimens of great interest. In conclusion the speaker begged to move a hearty vote of thanks to Professor Webster for his suggestive, timely and valuable paper.

This being seconded by Rev. Dr. Fyles, was carried unanimously.

NOTES ON PAPILIO BREVICAUDA, SAUNDERS.

By A. F. Winn, Montreal.

This species is either extending its habitat or has always had a wider range than credited to it, for I can now record its occurrence at Kamouraska, Que., a village on the south shore of the St. Lawrence about 85 miles below Quebec. (Lat. 47° 33″ N.)

Its locality as given in Scudder's Butterflies is "Newfoundland and the shores and islands of the Gulf of St. Lawrence both north and west," but I think Percé (Gaspe Co.) is the only recorded place on the south coast.

In July, 1889, a specimen was sent to me from Bic (Rimouski Co.) and arrived in a battered condition, but during the many seasons that I have spent my fortnight's vacation at Metis, about 30 miles further down, I have never seen the butterfly on the wing.

Rev. Dr. Fyles stated that a specimen had been taken last summer on the Island of Orleans, P. Q., by Mrs. Turner, of the Quebec Branch.

In 1896 I had not made up my mind where to spend my holidays and wrote Mr. L. Reford at Metis, asking him whether he was finding any good specimens and whether there was any hotel accommodation. He replied that he had taken a number of good things, among others a Papilio larva, and that there were plenty more to be found on a beach plant resembling celery.

I left for Metis on August 16th and found on my arrival that most of the larvae were nearly full grown, but a few were in their third stage. Some that Mr. Reford had in his house were just entering the chrysalis stage. We boxed all the mature larvae we could find and left the younger ones to feed on the archangelica plants during our stay, and before starting home gathered all we could find along with a supply of growing plants in tomato tins. The plants stood the journey well and grew nicely in the garden and we had no difficulty in getting all the larvae into chrysalis, but neither of us was successful in breeding a butterfly. All of my chrysalids were attacked by the parasite, which destroys so many P. asterias chrysalids—*Trogus exesorius.*

Thinking the species might be different I sent a specimen to Mr. Harrington of Ottawa, who has kindly determined it as the dark form of T. exesorius.

From larvae obtained the following year (1897) Mr. Reford managed to get one fine imago, which hatched in midwinter.

During the past summer I spent my vacation at Kamouraska, arriving there on August 13th and remaining until the 28th, spending part of 13th with Dr. Fyles at Levis. On the morning of the 14th while walking along the beach I noticed some rocks of the same slate formation that we had found the food plant of *brevicauda* among at Metis and after a few moments was pleased to find two or three plants but could find no larvae. A few yards further on, however, there were a number of plants and on them several larvae in their second stage, some in the first and some eggs.

The eggs are pale yellow, smooth and spherical except that the base is considerably flattened, and are attached mostly to the upper surface of the leaves, but sometimes to the lower side and on the stem and a few were on surrounding objects including a stick which lay across the rocks and on the rock itself.

Before hatching the egg becomes slate color. The larva has already been described and is so like P. asterias in all its stages that I could observe no points by which the two species could be distinguished.

I sent some larvae to Dr. Fyles at Levis and some eggs to Mr. Brainerd of Montreal, keeping a few eggs myself, and of these the first hatched August 15th and the first chrysalis was formed August 31st, making a larval period of 16 days—a remarkably short one, as Scudder observes, for such a high latitude. A number of larvae and eggs were found during the whole of my stay and when I examined the plants for the last time on the 28th the full grown larvae were crawling over newly laid eggs, and larvae of all sizes were side by side.

The first butterfly I saw was on the afternoon of the 14th, a little way back from the shore, but I afterwards found that the foodplant grew in a ditch in the same field. I failed to capture this female, and saw no more until the following Sunday (21st) when a party of us went to Tache's Point, a rocky promentary covered with trees, about a quarter of a mile north of the church. Several broken males were caught, but not having my net I could not catch the few that were in good condition. After lunch I returned with my net and caught one male in fair condition, and a number that were otherwise. On the 22nd I took a run on my bicycle along the main road towards Riviere du Loup, and got off at the bridge crossing the St. Paschel river, and followed the dyke, which the farmers have built to keep the sea out of their fields, and along the dyke the Archangelica grows in profusion. Eggs and larvæ were plentiful, but in no case more than four larvæ on one plant. I put my net together and waited for butterflies, but a strong wind was blowing which almost made me give up for the day, when a female fluttered through the fields, stopping to lay an egg here and there. I saw that the specimen was a damaged one, and thought that it would be best to watch it for a while, so got into a ditch where the food plant was most abundant, and the butterfly soon settled close to me and laid an egg on the top of a leaf, then went underneath and laid another, and finally crawled down the stem, or rather backed down, laying a third egg at the juncture of the three footstalks of the leaves. As it was flying off I caught it and boxed the eggs. Two of these hatched August 31st, the third did not hatch, although the larva was fully formed within. The egg stage is thus about nine days, and from laying of eggs to chrysalis is less than a month under favorable circumstances.

Regarding the feeding habits of larvæ, Scudder says (authority Mead) that "they are very susceptible to cold, prolonged darkness, or confinement of any kind, and when not feeding they either rest on the leaves in full sunlight or bask on the hot stones." My experience at Metis and Kamouraska does not corroborate these statements, for not having any proper breeding cages with me I kept my larvæ in the absolutely light-proof boxes used for photographic plates, and though I had at times as many as sixty in a box, I never had a healthier lot of larvæ. The young larvæ when at rest certainly lie on the top of the leaves in the sunshine, though you will rarely find a full-grown one in this position, but search the stem and the old ones are easily seen, and smelt too. Several times I visited the plants before breakfast, about 6.30 a.m., and found that all were at work and none at all on the stems, and on August 26th some were seen feeding at 8.30 p.m., though moonlight is not good for observation of this kind.

In the chrysalis there are two distinct forms, the green and yellow, and the light and dark brown, and I find that all my larvæ which suspended themselves on stems of the plant have produced green pupae, while those that crawled into boxes and shelters that I provided for them have assumed the brown form.

The species is regarded as single brooded, quoting Scudder again, "flying in June and the first half of July, and is most abundant the latter half of June. Eggs have been ob-

tained from June 14th for a month, some chrysalids carried south gave out the butterfly the same year, one in eighteen days."

If in the northern part of its range the butterflies fly through June and begin to lay eggs before the middle of the month, it seems probable that it should occur in a warmer region, such as Kamouraska, even earlier, and there would be ample time for a second brood before the middle of August, but to settle this point it would be necessary to see the butterflies on the wing and eggs laid in June, and chrysalids in July, and some member of our newly formed Quebec branch could easily solve the matter. Finding the species in so many stages at the same time seems to me to favor the idea that there are two broods, as in my experience in species that are single brooded the imagos appear for a short period with great regularity, and in the early stages the moulting and pupating of all are within a comparatively short time of one another, but in two brooded species the first brood is regular and the second not, while in many brooded species, such as *Pieris rapae* and *Grapta interrogationis*, the last broods seem hopelessly mixed up.

The last femalethat I saw on the wing at Kamouraska seemed to be a perfect specimen and if single brooded must have spent at least eleven months in the chrysalis, which Gosse states (Can. Ent. XV, 45) is the period of this species in Newfoundland.

Dr. Fyles, in commenting on the paper, said that he had received some of the larvæ from Mr. Winn, with a supply of food-plant; when this was exhausted he endeavored to find a substitute, but the larvæ were very hard to please. Eventually he succeeded in getting them to eat the leaves of parsnip, though they would not touch carrot, on which the larva of *P. asterias* feeds. He found that the chrysalids formed on the stem of the plant were like it green in color, while those which transformed in the box were brown. (Specimens of both were exhibited). He had five chrysalids in good condition, from which he hoped to obtain the butterflies,

Dr. William Saunders, the original describer of the species, upon being called upon said his specimens were sent to him from Newfoundland by a collector there, and he had never met with it personally. He was very much interested in the careful work detailed by Mr. Winn; just such work should be done in every species, studying it in every stage until its life history was completely known. The society has shewn by its publication of so many original papers in the *Canadian Entomologist* that it fully appreciates this line of work, and he believed that in no other publication had so many and such valuable papers appeared as in our own magazine.

The meeting then adjourned, it being six o'clock p.m.

THE CONVERSAZIONE.

On the evening of the 8th November a very enjoyable Conversazione was held at the Natural History Society's Museum.

This was got up by the Montreal Branch in celebration of the 25th anniversary of its formation, and with the kind assistance of the Natural History Society and Microscopical Society of Montreal and the Parent Entomological Society, which all gave grants towards the expenses as well as other assistance.

Unfortunately there were other powerful attractions as Lord and Lady Aberdeen were making their farewell visit to Montreal and it was also the opening week of the much advertised new theatre, Her Majesty's, but in spite of these other attractions about two hundred guests accepted the invitation. The guests were received by Mr. Henry H. Lyman, President of the Entomological Society, and Mrs. Clarence Lyman, Dr. F. J. Adams, President of the Natural History Society, and Mrs. Adams, Mr. Albert Holden, President of the Microscopical Society, and Mrs. Holden. Among those present were noticed Mr. Samuel Finley, a Governor of McGill University, and Mrs. Finley, Dr.

and Mrs. Wm. Saunders of Ottawa, Mr. and Mrs. Fysshe, Mr. and Mrs. Beaudry, Dr. Girdwood, F.R.S.C., Prof. of Chemistry in McGill University, and Mrs. Girdwood, Rev. Dr. and Mrs. Campbell, Mr. J. H. Joseph, Prof. MacBride, Prof. of Zoology in McGill University, Mrs. Cox, Mr. Sumner, Mr. J. D Evans, C.E. of Trenton, Mr. and Mrs. G. C. Dunlop, Prof. and Mrs. Donald, Mr. F. S. Lyman, Q.C. and Miss Lyman and Miss Cassels, of Washington, Mr. and Miss Scott, the Messrs. and Miss Brainerd, the Misses Dunlop, Dr. Shirres, Dr. Deeks, Mr. Winn, Mr. Clarence Lyman, Mr. Walter Lyman, Mr. and Mrs. Plimsoll, the Misses Redpath, Mr. and Mrs. Lighthall, Mr. De Sola, Mr. and Miss Cramp, Mr. and Mrs. Gibb, Mr. C. T. Williams, Mr. Stevenson Brown, Mr. J. B. Williams, F.Z.S., Mr. Dearness and Mr. W. E. Saunders, of London, Mr. Gibson, of Toronto and many others.

Shortly after 9 o'clock the three presidents proceeded to the platform, which was decorated with palms and chrysanthemums, along with Rev. Dr. Bethune of Port Hope, Dr. Fletcher of Ottawa, and Rev. Dr. Fyles of Quebec. Mr. Lyman called the gathering to order, the guests seating themselves to listen to the addresses, and in a brief address welcomed the guests to this celebration and traced rapidly the history of the Branch from its formation on the 16th October, 1873, pointing out that so far as he could ascertain it was the third senior existing entomological society in North America, being only antedated by the American Entomological Society of Philadelphia and the parent society at London, Ont., and stating that 217 meetings of the branch had been held, at which over 200 original papers had been read, of which some 80 had been published.

Mr. Lyman briefly referred to the vast economic importance of the study and as an illustration mentioned that during the current year the State and Federal authorities of the United States were devoting no less a sum in the aggregate than about $350,000.00 to the prosecution of economic entomology.

Mr. Lyman expressed his regret that he had been unable to secure the attendance of any entomologists from the neighbouring Republic although pressing invitations had been sent to Dr. Howard, Dr. Holland, Prof. Webster, Mr. Slingerland and Mrs. Slosson.

After announcing that Dr. Bethune, Dr. Fletcher and Dr. Fyles would also deliver addresses, Mr. Lyman resigned the chair in favour of Dr. Adams.

The Rev. Dr. Bethune, Port Hope, one of the founders of the original society, and second President, spoke briefly of the work done by the parent society, and of the rise and progress of entomology in Canada.

Dr. Fletcher, the Dominion Official Entomologist, Ottawa, touched upon the economic aspect of the subject, and the value of a knowledge of entomology.

The Rev. Dr. Fyles, President of the recently formed Quebec branch, spoke briefly of the work done in that city. He also presented greetings from his branch to the Montreal branch.

On the conclusion of the addresses the majority of the guests repaired to the museum up stairs, though some lingered in the reception hall to examine the many beautiful objects, chiefly of an entomological character, which were exhibited under a large number of powerful microscopes by members of the Microscopical Society. The stairway and entrance to the museum had been tastefully decorated with flags, butterfly nets and other entomological paraphernalia, two long handled nets for working electric arc lights being especially noticeable.

The orchestra under the direction of Mr. Charles Reichling, which had been playing during the reception of the guests, took up a position in the gallery and discoursed sweet music during the remainder of the evening.

In the museum hall a fine exhibit of insects, chiefly Lepidoptera, was displayed the show cases being further embellished with potted plants.

The exhibits were chiefly furnished by the members of the Montreal branch, Mr. Lyman, the President and Mr. Winn, the Vice-President, each showing 30 cases exemplifying all the families of North American Lepidoptera except the micros. Mr.

Brainerd showed six cases beautifully illustrating the life histories of a number of interesting species, while Mr. Dunlop contributed an equal number of cases of striking exotic species. Mr. Norris showed about half a dozen drawers illustrating Montreal species as well as the method of preparing and spreading lepidoptera, while Mr. J. B. Williams exhibited an interesting case showing the life history of the Walking Stick (Diapheromera Femorata). In addition to these exhibits by members of the branch, the Museum Committee of McGill University contributed six large cases of strikingly beautiful tropical butterflies mounted on the Denton tablets, while the Natural History Society showed its collection of Canadian Coleoptera and a few drawers of exotic Lepidoptera.

Refreshments were served about half past ten o'clock and a very enjoyable evening was brought to a close shortly after 11 p.m.

ELECTION OF OFFICERS.

After a meeting of the Council had been held for the transaction of business, the general session of the Society was resumed at 11 o'clock a. m., Dr. Bethune occupying the chair at the request of the President. The first proceeding was the election of officers for the ensuing year, which resulted as follows: See page 2.

THE FARMERS' GARDEN AND ITS INSECT FOES.

REV. THOMAS W. FYLES, D.C.L., F.L.S., SOUTH QUEBEC.

Once upon a time some new tenants came to a farm-house in the neighborhood in which I was residing. A former owner of the place had enclosed a piece of ground on one side of the house and had formed a lawn and flower-beds, and planted fruit bushes and ornamental shrubs. The place was a quarter of a mile from my home; and one day I walked down to see the new-comers. I found them busily engaged in driving half-a dozen hogs into the enclosure I have mentioned. I ventured to suggest that the animals would play sad work with the flowers. This was the reply—"from a heart as rough as Esau's hand,"—"Flowers, flowers! The only flowers we care about are cauliflowers!" The answer expressed the prevailing contempt, in that comparatively new settlement, for everything like home adornment. I ought not to say *everything*, for an exception must be made in favor of bed-quilts. The females of that neighborhood spent much of their spare time in the manufacture of bed quilts. The choicest kinds were white, and had Turkey-red flowers and fruits, and intensely green leaves of impossible shapes trailing all over them. The possessor of a dozen varieties of such "spreads" was a proud woman. She would occasionally hang her art-treasures in the open space in front of her house, to excite the envy and admiration of her female neighbors, who would occasionally light their pipes and stroll round to examine the patterns.

The typical farm-house, at that time, and in that part of the country, was a story-and-a-half, oblong building, covered with rough, unpainted, hemlock boards. The main door was at one end and opened into the living-room. It and a trap-door into the cellar were, in some instances, sheltered by a rude veranda. In the door, near the bottom, was usually found a circular hole with a lengthened slit above it, in which a light shutter fitted to the opening, was suspended on a wire to allow egress and ingress to the cat. A story was told of a man who had two such openings made—a larger and a smaller—for the convenience of the cat and the kitten.

This primitive dwelling usually stood on a knoll in a yard open to the road. The yard, which was the receptacle for the refuse of the house thrown from windows and doors, was encumbered with logs drawn up for fuel, and was littered with chips. It was the common play-ground—if I may be allowed so to *generalize*—of the poultry, pigs and pickaninnies; and in it, in the summertime, one or two "smudges" were kept burning to drive away the mosquitos and black-flies.

The vegetables used by the people of that locality at that time were chiefly of field growth,—potatoes, Swedish turnips and pumpkins. The fruits were apples, from seedling and ungrafted trees, and the wild berries of the country,—strawberries from the meadows, raspberries from the pastures and roadsides, and "high-bush" cranberries from the swamps. The raspberries were spread on sheets of hemlock-bark, and dried in the sun for winter use; the strawberries and cranberries were preserved with maple-sugar. I remember my only experience of cranberry jam. It was at a party to which I was invited. I found myself incommoded by the large, flat, crustaceous seeds with which the preserve abounded. I stole a glance around to see how my neighbors disposed of these seeds and I found that the orthodox plan was to swallow them whole. I tried this for the occasion, but from that day forth I carefully avoided "cranberry sass"—as it was called in the vernacular.

Happily the race I have spoken of have passed away. Many of them were seized with the "Western fever," and moved to North Dakota and other distant places, to retard civilization in them. Their rude dwellings also are gone, or have been altered out of recognition. The succeeding generation is more enlightened and refined. The change has been largely brought about by the agricultural association and county fairs, which, through their prizes given for the best-cultivated farms, the best gardens, the finest vegetables, fruits, and flowers, and the choicest productions in the arts of life, have done a vast amount of good. Improved schools, superintended by well-trained teachers, have fitted the rising generation to appreciate the agricultural and horticultural literature that has been widely circulated—reports and bulletins from our Experimental Farms and Scientific Associations; papers and magazines on rural affairs; and last, and I venture to say not least, illustrated catalogues from our seedmen and florists. These last have done much to create and foster a taste for horticulture. Now moreover improved machinery and garden implements enable the farmer to carry on his gardening operations with ease and expedition; so that good results around the homestead may be obtained without detriment to the operations on the farm at large.

My ideal of a farmer's homestead is this: a house facing the road, but a little back from it, having convenient verandahs—that to the front being furnished with wide-meshed wire netting extending from its base to its roof, for the support of such climbing plants as the English honeysuckle and Jackman's clematis. The Virginia creeper, which is a favorite on account of its free growth, is apt to hold moisture and rot the wood-work. If grown at all it should be often trimmed.

Behind the main building should be an extension connected with the dairy, wood-shed, etc., and facing this a yard, approached by a sideroad, and bounded by a shed for vehicles. Beyond this shed should be the cattle-yards with shelter for the animals, and then the barns.

In the lee of the buildings, though not in their shadow, I would have the ground for small fruits, and beyond it the orchard. The bushes should be planted in rows, and far enough apart to allow a steady horse with a cultivator to pass between them. Nothing is gained by crowding plants. The use of the cultivator and hoe should keep the ground around and under the bushes clean.

The kitchen-garden proper should be unincumbered with bushes and permanent paths, so that the manure carts may be driven anywhere over it, and the ground thoroughly ploughed in the fall, and again in the spring. I would have no partitions of beds except such as might be made with the hoe or shovel as occasion required.

The drive to the front of the house should come with a sweep round the central bed, and be flanked with flower-borders. Beyond these would be the lawn, with ornamental shrubs planted singly or in clumps: syringas, Tartarian honeysuckle, viburnum plicatum, the purple-leaved berberry, and lilacs white and purple.

In the front bed the house-plants moved from the windows when the green blinds were replaced would find suitable summer quarters, and a vase in the centre of it containing trailing and other plants would add to its beauty.

For the flanking beds, plants that require little attention and make a good show are desirable. To my mind the old favourites are the best—low shrubs like the Mahonia, moss-rose, and flowering currant; St. Joseph lilies; perennials such as iris, Chinese pæony, dicentra, perennial phlox and bee-larkspur; biennials as the Sweet William, Canterbury bell, foxglove and hollyhock—the last named, judiciously placed, produces a fine effect. Such plants require but little time for their cultivation. The forking in of a dressing of manure, an occasional shifting of place and dividing of them to prevent overgrowth, are the main operations required.

Around the whole should be a sheltering belt of evergreens—young pines, hemlocks, and Norway spruce. A few inexpensive rustic seats placed here and there under the trees would give an air of repose to the scene.

Supposing the buildings, yards, gardens and orchard to occupy five acres out of a hundred acre farm, the space will be well and profitably taken up.

Now what insect foes would the owner of such a property have to contend with The insect spoilers are numerous. For convenience we may group them into—

(I.) Those that suck.
(II.) Those that bite.

Each group may be sub-divided into—

(1) Open workers.
(2) Hidden workers.

And the methods to be taken against them may be spoken of as:

(*a*) Preventive.
(*b*) Destructive.

Of insects that suck the different kinds of plant-lice and scale-insects are most to be dreaded. They belong to the families APHIDÆ, COCCIDÆ and COCCINÆ in the order HEMIPTERA.

Some species of them are familiar to many persons. Their fondness for house plants has brought them into notice; and the difficulties experienced in exterminating them have created a desire for further information as to their nature and habits.

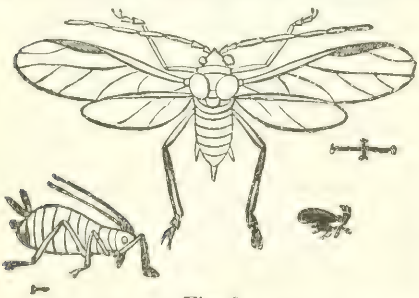


Fig. 6.

The perfect male and female aphides appear late in the year (Fig 6). The female deposits egg-like capsules upon the stems and branches of the food plant of her kind. Each capsule contains a perfect louse, which, in early Spring, bursts from its envelope and becomes a stem-mother capable of producing 90 or 100 creatures after her own likeness, and as prolific as herself. Seven or eight generations of such agamic producers succeed each other—their numbers increasing by geometrical progression till they count up to billions.

The stem-mother of the aphis has a flask-like body from which project two small spouts. Its head is furnished with a proboscis, which the inscet drives into the substance of the leaf or bark of its food-plant, for the purpose of imbibing the sap. In the process of digestion, the sap imbibed is converted into the "honey-dew" which the insect now and again ejects from the spouts above metioned.

The plant is injured, in the first place by the withdrawal of nourishment from it, and in the second, by the clogging of its stomata, or breathing-pores by the accumulation of the viscid honey-dew.

Now it is evident that the aphides cannot be assailed through their mouths by poisonous spraying, as the leaf-eating insects can. They cannot be poisoned, but they can be suffocated. Whatever effectually closes their spiracles brings death to them. Spraying with kerosine emulsion, applications of whale-oil, size, pyrethrum, tobacco smoke, are all effective.

To witness the deadly effects of oil upon an insect, apply with a feather or camel's-hair brush a drop of linseed oil to the body of a troublesome hornet or bumble-bee buzzing in the window. The end comes quickly! The oil is not taken into the stomach of the insect, but is spread over its body, and clogs its breathing-pores, and the insect dies.

The aphides left to run their course, at length give rise to a generation of winged insects; and these proceed to make the preliminary arrangements for the next year's round of aphidean gatherings and festivities.

The aphides are named according to the plants they frequent. Thus we have:—

The aphis of the apple, *A. mali*, Fabricius.
" " plum leaves, *A. prunifolii*, Fitch.
" " currant, *A. ribis*, Linnæus.
" " cherry, *Myzus cerasi*, Fabricius.
" " cabbage, *A. brassicæ*, Linnæus, etc, etc.

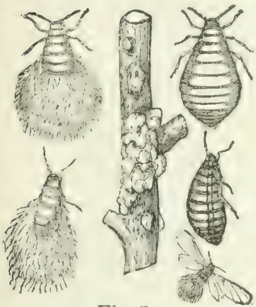


Fig. 7.

An easy way of smoking a house-plant is to turn an empty flour barrel over it, at the same time inserting a suitable vessel containing two or three pinches of tobacco and a small live coal. The smoke will soon do its work.

For the destruction of that troublesome insect the woolly aphis or "American Blight" (*Schizoneura lanigera*, Hausmann) (Fig. 7) which is found in white patches on the apple trees, the use of a scrubbing brush with diluted soft soap is recommended. By this means the insects are crushed and the tree cleansed at the same time. The house plants may be freed from that trouble-pest, the common mealy-bug (*Dactylopius adonidum*, Linnæus) by more gentle treatment of like nature.

The aphides have many natural foes. Among them are various kinds of lady-birds, the lace-winged flies and syrphus flies, all of which are predaceous upon them—destroying them from without; and an aphidius which is parasitic, destroying them from within.

Insects even more difficult to deal with than the aphides are the scale insects. The scrubbing-brush and soft soap may be used for their discomfiture. All the insects that we have yet considered work in the open air. There are others that live by suction, but operate under ground. The most formidable of these is the Dog-day Harvest Bug, *Cicada canicularis*, Harris.

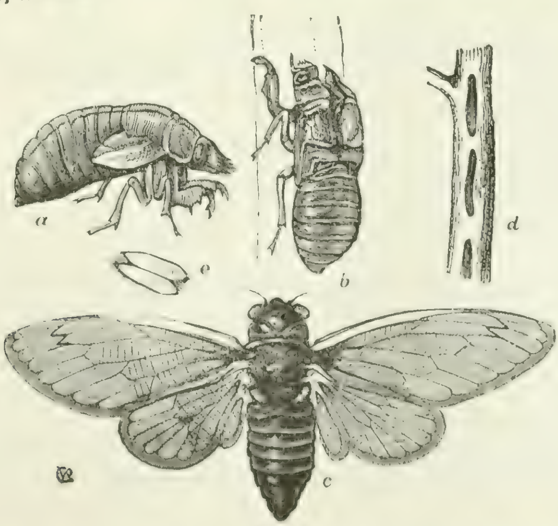


Fig. 8.

I made acquaintance with this insect many years ago, in Montreal. I was walking up Mountain Street, and, when near the top of it I saw a very seedy looking individual

of the bug tribe creep from the soil at the foot of a large elm-tree (Fig. 8a) and begin to climb the trunk. I sat down and watched it. After ascending about two feet it dug its claws (It was very well provided with claws!) into the irregularities of the bark and took a firm hold. It then commenced to writhe and twist as if it were taken with a violent internal disorder. Surely something will come of all this commotion I said to myself; and something did result—its skin was suddenly rent from the head to the abdomen (Fig. 8b), and the creature began coolly to crawl out of its own skin, drawing out its legs as if it were taking off its boots. When quite free it shook out its wings, and in a few moments presented the appearance of a perfect cicada. (Fig. 8c.)

The female cicada is furnished with a remarkable organ, one part of which resembles a double key-hole saw. With this she cuts into the bark of the tree and forms a receptacle for her eggs. These eggs she carefully deposits. After a while they hatch, and the larvæ which come from them find their way to the roots of the tree, into which they thrust their beaks. Then commences the work of suction that lasts for a length of time—the juices of the tree being the only nourishment the creatures receive. One species of cicada (*C. septemdecim* Linneus) spends 17 years at this employment.

It is in orchards of some standing that the cicadas are most likely to establish themselves; and it may be that the operations of these hidden foes have more to do with the occasional shortage of fruit than people have an idea of. How to reach the spoilers is a problem. Probably one of the best suggestions that has been made is, to enclose the orchard with a sufficient fence, and then, to do as the people above-mentioned did with the garden—turn the hogs into it. The animals will grub (*grub* is a very appropriate word!) about the roots, and destroy a variety of larvæ and pupæ. They will loosen the sod and let in the air; and their droppings will help to fertilize the soil. The use of the bush-harrow and the rake, and the scattering of a little grass seed after the animals have been removed will repair the damage they may have done.

Against the biting insects the campaign should begin after the leaves have fallen. The fruit-trees should then be carefully examined for the eggs of some kinds and the cocoons of others. The beadlike eggs of the Brown Vapourer (*Orgyia antiqua*, Linnæus,) attached to the vacated cocoons of the mother insects, and the egg-patches of the Gray Vapourer (*O. leucostigma*, A. & S.), covered with a protective that resembles sugar frosting, will be found readily enough where the creatures are plentiful. The brown elongated masses of the eggs of the Lackey Moths (*Clisiocampa Americana*, Harris, and *C. disstria*, Hubner,) should be looked for on the twigs (Fig. 9), and when found cut away and destroyed, as should also the cocoons of the Saturnians.

Fig. 9.

As soon as the buds appear in the spring, Paris green and water well stirred should be applied to the fruit trees by means of a force pump and spraying nozzle. This spraying will destroy the injurious "bud-worms," "leaf crumplers," "canker worms," etc., and later applications will overcome those troublesome pests the "tent-caterpillars" and "fall web-worms," and other less conspicuous foes.

White hellebore, applied with a dredger, or mixed with water and sprinkled with a can over the fruit-bushes will kill the larvæ of the "currant saw-fly" (*Nematus ventricosus* Klug) Fig 10, and those of the span-worm (*Enfitchia ribearia* Fitch) Fig 11. A like application to the rose bushes will free those plants from "slug-worm" (*Selandria rosæ* Harris), and from the leaf-crumpling caterpillars of the pretty little brown and white Tortrix *Penthina nimbatana* Clemens).

With one notable exception our butterflies can hardly be said to be injurious. The larvæ of most of them feed on weeds or plants of little value. A few of them feed on cultivated plants.

Papilio turnus Linnæus, feeds on the apple, etc.

P. asterias Fabricius, feeds on the parsnip, carrot, etc.

Pieris oleracea Bd. feeds on the potherbs.

Grapta interrogationis Fab. feeds on the hops, etc.

G. progne Cramer, and *G. gracilis* G. and R. feed on the currant.

Thecla strigosa Harris, feeds on the plum.

Fig 10.

Fig 11.

But these insects are few in number, and so widely scattered, that they do little, if any, harm.

Fig 12.

The one exception is *Pieris rapæ* Linnæus, the "cabbage-butterfly" (Fig 2). This is an exceedingly troublesome insect. The best method to check its ravages that I know is to set an intelligent child to work to pick off the caterpillars (Fig 12 *a*) from the plants, and to crush them under foot. The chrysalids (Fig 12 *b*) of this species, and of others, may often be found attached to fences and buildings.

I lately had the opportunity of witnessing the proceedings of a Papilio brevicauda larva when about to change to a chrysalis. It spun, on the side of a twig, a little pad, to which it attached itself, having climbed into a proper position for doing so. When it had settled itself, it turned its head to its back and ejected, through its mouth, a drop of mucous which it drew out in a silken thread, and attached to the twig. It then turned its head round on the other side, and deposited another drop on the same spot, drawing it out and fastening it as before, thus making a complete loop. The ends of this it strengthened with a branching web. Having completed its arrangements it curved its shoulders, drew in its head, and remained quiescent for two or three days—that is, till its loop and other fastenings were firm and dry. Then its skin was rent at the thorax, and, by a succession of heaving and swaying motions, was worked back, segment by segment, till it reached the extremity or cremaster, from which, in a little while, it fell away, leaving a delicate green chrysalis with a row of yellow knobs on either side, and with pretty salmon-coloured spiracles.

The farmer no longer dreads the Colorado potato-beetle, *Doryphora decem-lineata* Say (Fig 13). He knows how to deal with it; and its numbers are diminishing, thanks to the information spread through the country by entomologists, on the use and efficacy of Paris-green.

Fig 13.

It was a remarkable sight, in the early days of the potato-bug visitation, to see all the available members of a farmer's household busily engaged in beating off the "bugs" with small sticks, and catching them in milk cans; now and again emptying their prey into the fire over which soap was in the making, or pig's food in the cooking. "*All was fish that came to net*," and so beetles and their parasites—"friends and foes," were—

——— "in one red burial blent."

Men are sometimes surprised to find the potato-beetles feeding on the tomato and tobacco plants in their gardens. The insect in its native haunts fed on the wild potato, *Solanum rostratum*. Of the *Solanceæ*, or Nightshade Family, to which the potato belongs, there are in north America six genera—not counting the South American genus Petunia, now so largely cultivated in gardens. They are (1) *Solanum*, nightshade; (2) *Physalis*, ground cherry; (3) *Nicandra*, apple of Peru; (4) *Hyoscyamus*, henbane; (5) *Datura*, thorn apple; (6) *Nicotiana*, tobacco. The first of these includes the potato, the egg-plant, and the tomato, all of which are eaten with avidity by the beetle. Deprived of its favourite supplies, the insect turns to such other members of the family as may grow within its reach. I have found it upon Physalis and Datura, as well as upon Nicotiana.

Of enemies working covertly, the cut-worms are among the most troublesome. They are larvæ of certain kinds of Noctuid, or night-flying moths. Whenever a farmer sees a

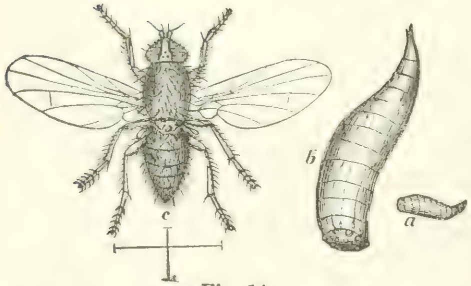


Fig. 14.

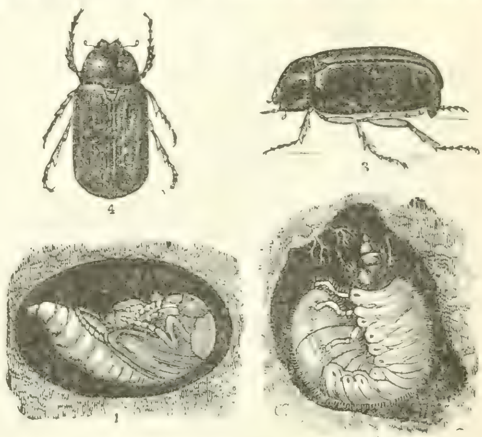


Fig. 15.

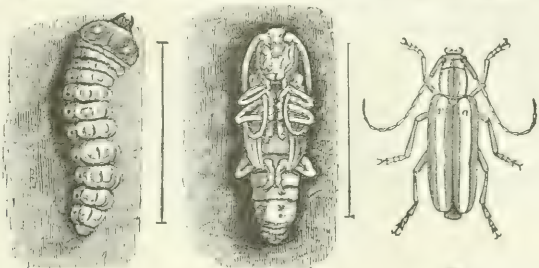
blade of corn falling over and turning yellow, or a cabbage-plant bitten off near the ground, he may be very sure that a cut-worm is working there, and should use a spud or

pointed stick to unearth the spoiler. To foil these pests the young plants should be earthed up as soon and as far as possible, for the creatures crawl over the surface, at night, and cannot ascend a mound of crumbling earth.

Young onions are damaged both by the cut-worms and by the maggots of the onion-fly, *Phorbia ceparum* Meigen (Fig. 14). The former work singly ; the latter, in groups. Both should be carefully dug out and destroyed. Dry soot scattered over the onion-bed is believed to be serviceable in keeping away the fly.

The "white-grubs," or larvæ of the May-beetle, *Lachnosterna fusca*, Frohl. (Fig 15) are well-known pests. In the fields the plough unearths them ; and the poultry, following in its wake, hold high carnival, and become fat and well-liking. In a thoroughly-worked garden the grubs find but little harborage.

The hidden pests above mentioned can be dealt with more easily than some others.



a b c

FIG. 16.

The apple-tree borer, *Saperda candida* Fab. (Fig. 16), works near the ground, in young trees, and so weakens the stems that sometimes, in a high wind, the trees are snapped off. The larvæ betray their presence by their *frass*. When this is the case a wire should be thrust into the tunnels, for the destruction of the occupants. A thick wash of soft soap applied to the stems in June will deter the beetles from laying their eggs upon them.

There are other borers that injure other trees. It is in search of these that the woodpeckers work so systematically around the stems The woodpeckers are among the fruit-grower's allies, and should not be molested.

Fig. 17.

The borer of the currant stems is the larva of a pretty little clear-wing moth, *Ægeria tipuliformis* Linnæus (Fig. 17). Late in the fall all unhealthy-looking stems in the red, white and black currant-bushes should be cut out and burned. The moths appear in June, and consort for safety with the small black wasps of the genera *Odynerus* and *Gorytes*, which they somewhat resemble. A child can soon learn to distinguish them from these, and can spend a few bright midday hours profitably in capturing the moths with a butterfly net. The capture of one female will save many currant stems from damage.

We have, then, glanced at some of the worst of the insect pests that frequent the farmer's garden. The study of them in their native haunts will be found full of interest and a knowledge of their proceedings and the various methods of counteracting them will prove of great value, and ought not by any to be lightly esteemed.

ON THE NOCTUIDÆ OCCURRING AT TORONTO.

BY ARTHUR GIBSON, TORONTO.

For some time past, in fact ever since the season of 1896, I have considered the Noctuids to be my special favourites amongst the Lepidoptera, and in view of this I thought a few remarks under the above heading might interest those present.

The Noctuidæ comprise that large family of Lepidoptera known as the "Owl-let" moths, or night-flyers. As a rule, the members of this family feed by night and rest during the daytime. Some of the larvæ of these moths, commonly known as cut-worms, are amongst the most destructive of our caterpillars. The ravages which they have been recorded as making, resulting in the losses of certain agricultural products, have been enormous. Around Toronto, as far as I know, their devastations have not amounted to very much, comparatively speaking. In the regions most infested with these pests, the loss to agriculture is tremendous, but the ravages thus caused have been reported so fully in Government publications that it is not necessary for me to say anything further about their destructive propensities. It might not be out of place, however, to mention that on account of these larvæ being night feeders, all of their devastations are perpetrated after dark, in the daytime the caterpillars hiding under crevices, stones or any other article under which they can escape notice.

To the collector of these moths there are various novel ways of procuring specimens. The two most indulged in, in Toronto, are taking advantage of the electric lights, especially in the outer districts, and by the still better way of "sugaring" the trees. In the early part of the season, say until towards the last week in June, the Noctuids that are then flying seemingly prefer the electric lights to the "sugar"—such is my experience. By the first of July they start to come to the "sugar," and from then until the end of August, and even beginning of September, lots of good work can be accomplished. Some Noctuids which are often taken at "light" are seldom captured at "sugar," while on the

Fig. 18.

other hand specimens like the catocala are generally taken at "sugar." Relicta (Fig. 18) is about the only catocala which I have noticed around the lights to any extent. During the end of August of last season quite a number of Relictas were to be seen at "light," while I have, as yet, only met with one specimen at "sugar." Collecting with the aid of "sugar" is much the better way, not only as regards the number of specimens taken, but also in view of the variety of Noctuids secured. The season of 1897 was an ideal one for "sugaring" purposes in Toronto. One evening as many as 26 specimens of catocalæ were taken by Mr McDunnough and myself while out together, besides a large number of smaller interesting Noctuids.

It is safe to say that among the Noctuids we find some of our most beautiful moths, but on the other hand some of them are most inconspicuous in color, being of a dull gray, brown, or black, or these colors combined.

In North America, according to Prof. J. B. Smith's List of Lepidoptera of Boreal America, there are recorded no less than 1841 distinct species of this great family of Noctuidae, and since the compilation of this list there have been several new species described. On my list I have marked off about 160 different species, which I have taken at Toronto, besides quite a number of unnamed species. Probably there occur several hundred more representatives.

Among the various genera there are to be found some very interesting species. The first thing I have marked of on my list is Raphia frater. This moth is of uncommon occurrence, the specimens I have being taken at light.

The genus Acronycta is an interesting one, some of the members being beautiful insects. Around Toronto, I have taken 10 different species, viz., occidentalis (Fig. 19),

Fig. 19.

Fig. 20.

morula, populi, Americana, dactylina, hastulifer, luteicoma, brumosa, superans (Fig. 20), and funeralis. Of these probably funeralis is the most rare, while morula, dactylina and luteicoma are very scarce.

Harrisimemna trisignata, the only one of the genus, is a rather pretty moth; the three specimens I have were taken at light.

It is not necessary for me to mention every species of Noctuidae which I have taken, so I will just confine myself to the names of those which to me are considered of rare and of uncommon occurrence in the neighborhood of Toronto. In cases where it is possible I have mentioned whether the specimens were taken at "light" or at "sugar."

Microcoelia dipntheroides, fairly rare, taken at light.

Rhynchagrotis cupida, at sugar, very few taken. First time I took it was in 1896; very scarce since then.

Semiophora tenebrifera, one specimen at light.

Feltia venerabilis, only one specimen, taken at light.

Dicopis Grotei, one specimen taken at sugar, 13 June, 1896.

Mamestra imbrifera. Took one specimen of this beautiful insect, resting on the trunk of a tree, on the afternoon of 18th July, 1896.

Mamestra purpurissata, 1 sp. at light.

Mamestra grandis, 2 sp. at light.

Mamestra adjuncta, 1 sp. at light.

Mamestra latex, 1 sp. at light, 30th May, 1895, and one 9th May, 1896.

Mamestra rosea, very rare, two sp. at light, last capture 26th May, 1897.

Hadena lignicolor, rather uncommon, taken at sugar in June and July, 1895.

Dipterygia scabriuscula, 2 sp. taken at sugar.

Prodenia flavimedia, one sp. at light.

Trigonophora periculosa, 1 sp. at sugar and 1 at light.

Helotropha reniformis, fairly common, at sugar in 1896, rather scarce since then.

Hydroecia velata, 1 sp. taken at light.

Hydroecia cataphracta, 1 sp. at light, 9th May, 1894.

Pyrrhia umbra, 2 sp. at light, 4th May, 1896, and 2 sp. of the variety angulata on 20th June, 1896.

Orthosia ferruginoides, 2 sp. taken 21st Sept., 1895.

Scopelosoma Moffatiana, one of the early appearing Noctuids, 2 sp. taken at light, 20th April, 1896; also observed last season.

Scopelosoma ceromatica, also an early Noctuid, 4 sp. taken at light, 20th April, 1896. I have never taken either of the last two named, in the fall of the year, although I understand they hibernate in the imago state.

Calocampa curvimacula, very nice thing, 2 sp. taken at light, 20th April, 1896, and 1 sp. 17th May, 1897.

Cucullia asteroides, 2 bred specimens.

Cucullia intermedia, 3 sp. at light, 2 on 20 April and 1 on 16th April, 1896.

Among the Plusias there are some fine things. I have taken 8 different species marked off on my list, viz., aerea, aereoides, balluca (Fig. 21), striatella, bimaculata,

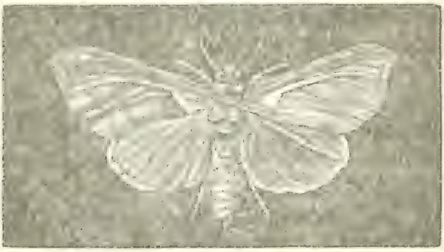


Fig. 21.

Fig. 22.

precationis, ampla, and simplex (Fig. 22), together with one un-named. Of these striatella, balluca, and ampla are the rarest, with simplex and precationis the commonest. All my Plusias were taken at light.

Heliothis armiger, one sp. taken 22nd Sept., 1895.

Alaria florida, very pretty moth, 4 specimens taken at light in 1894, never very common.

As to the Catocalas, I have taken 14 different species at sugar, the principal captures being, grynea, ultronia (Fig. 23), a beautiful variety of ilia, briseis, relicta, (Fig. 18), habilis, neogama (3rd Aug., '96) and retecta. The season of 1896 was by far the best I have yet experienced in collecting Catocalas, such species as ilia, cerogama, uniguga, and parta (Fig. 24) being very common. During the past season I did not notice a single specimen of ilia. I understand that C. cara was taken in Toronto last season.

Fig. 23.

Panopoda rufimargo, one specimen, taken at light.

Homoptera nigricans, one specimen at light.

Bomolocha baltimoralis, 2 sp. at light.

Brephos infans, one specimen taken on 11th April, and one observed on 16th April, 1898.

I have brought to the meeting some of the species mentioned in my paper, also a few "uniques" which, as yet, I have not got identified. Some of these will no doubt interest certain of the members present.

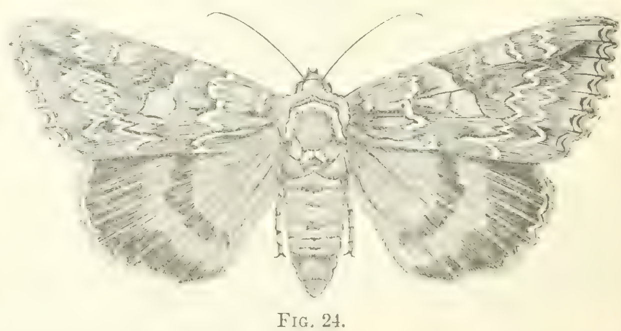


Fig. 24.

At a future date I may be able to relate, in a much better manner, something on the "Noctuidae occurring at Toronto," which may be of more interest than the article I have just read.

Mr. Gibson also exhibited specimens on the following very rare butterflies which he was so fortunate as to have captured at Toronto : Thecla Ontario, Pamphila Baracoa and Brettus ; also Pyrameis carye, which was taken by Mr. Tyers. T. Ontario has only been twice taken before in the Province from which it is named ; the other three are new to our Canadian list.

Mr. D. Brainerd disagreed with the writer of the paper regarding the superiority of light to sugar as an attraction for moths. Mr. Winn said that he had found sugar the best bait until June 15th, but after that flowers were the most attractive. He had taken 160 specimens between 7.15 and 8.15 one evening.

THE COLLECTOR AND HIS RELATION TO PURE AND APPLIED ENTOMOLOGY.

By F. M. Webster, Wooster, Ohio.

The insect collector may or may not be a professional entomologist. He may be a minister, doctor, lawyer, merchant, soldier or sailor. He may be confined within the walls of a counting-room, bank, office, study or other place of occupation, during eight or ten hours of the six days of the week, for eleven months of the year, or he may be camped for months in the wilderness, or spend months on the sea, with an occasional respite of a few weeks on shore. There are few professional collectors, the major portion of these being engaged in other pursuits, and spending the time generally devoted to rest or recreation by the majority of people, in the collection of insects, in itself a most pleasing and healthy sort of recreation, provided ones tastes trend in that direction. Thus it occurs that a collector may be confined to a limited area, or he may be able to carry on his work in widely distant localities. I know of a soldier, wounded and in a hospital, who managed to make a considerable collection of insects and especially such as are readily attracted to light, and another whose business, that of a commercial traveller, takes him from one end of the country to another. I have in my own collection, specimens taken at almost all hours of the day or night, under almost every condition imaginable, and in as great a diversity of localities.

Outside of professional entomologists, the collection of insects is largely a labor of love, with no hope or expectation of any compensation whatever. This, then, would appear to be the proper place to discuss the value of these self imposed labors to the science of entomology.

While much has been said and written, both pro and con, relating to the value of the services of those men and woman who collect but do not study insects, it has always appeared to me that in this, as in almost everything else, we should make a distinction between the careful collector and the one who, strictly speaking, could hardly be termed a collector at all. Of course industry and energy here as elsewhere, count for much, but care, neatness and accuracy are imperative. Then, again, there has existed a certain condition of affairs, happily now fast disappearing, under which a collector was obliged to humbly submit his hard earned material to a specialist for determination, which specialist, after condescending to go over it, retained the specimens for his trouble, and in the case of new forms, frequently forgot to give credit to the collector when naming and describing them. It was thought sufficient to state that specimens were from Canada, California or Texas. The description being sometimes drawn up from a single specimen, thought to be typical of course, because it was the only one in the hands of the describer, was often faulty, so that the danger to the pure science from discolored or deformed material getting into such hands was very considerable. It goes without saying if you place a lot of carelessly collected and prepared material in the hands of a specialist, who is simply a species maker, and whose judgment and accuracy is not above question, the result will be not only n. gen. et sp., *ad infinitum*, but time has shown that the sort of entomology that such work represents had best be spoken of in connection with an ?.

But this is one extreme and one that is fast being eliminated, all specialists of repute now giving full credit to the collector for material placed at their disposal, and frequently this is done at the request of the specialist himself. It seems to me that this is one of the most encouraging evidences of progress in entomological research, as the collector soon finds that with credit there, invariably, goes more or less responsibility, and we therefore get better and more careful collecting, while the specialist or systematist is placed in possession of better material and more elaborate data, and is thus better enabled to avoid mistakes and synonyms. But we must not lose sight of the fact that this material and data must be supplied by the collector, who may be so situated that he is not able to work up his material properly, while the systematist is often equally unable to secure these by his own efforts; and we thus have a division of labor, which, if faithfully carried out by both parties, can only result in much good, and material progress in our beloved science.

For my own part, I have come to look upon the labors of the careful collector, as having much the same relation to the science of entomology, as those of Livingstone and Stanley have to the advance of civilization in Southern Africa. These latter gentlemen did not fell trees and plow and sow, but they paved the way for these, and made civilization possible. The collector is the advance discoverer, who must be followed by the systematist before the biologist can commence his labors. We first must get our species, and then so define it as to prevent its being continually confused with other forms, else we cannot study either its own life or its relation to other species. In the history of the advance of civilization we have, first, the discoverer, next, the pioneer agriculturist with his log cabin, followed by cities and schools and churches and railways, all the accompaniments of civilized life, but all preceded by the one who first made his way through the trackless wastes and told of what he saw.

Now, about the collector and his work. He who cares nothing for habits, variations and geographical distribution, will accomplish the least for the advancement of the science, though, as has been stated, industry and push are neither one to be despised, and it is better to know that certain species are to be found in Canada, California or Texas, than not to know of their existence at all. It would be much more satisfactory to know just where in these areas the species were found, as all extend over a wide area and great variety of country. But just here let me call attention to a serious defect, and one that does not seem to be confined to the careless or inexperienced, viz., giving as localities of occurrence, isolated points, having local names which are unknown a few miles away, and are not to be found indicated on any of our maps. Such give no clue whatever to the one who is engaged in tracing out the geographical distribution of a species, as I have myself experienced after hours of fruitless search, finally giving up in despair. In all cases it is better to give exact localities with reference to their proximity to some point which is indicated on our maps; the approximate latitude and longitude will be the most stable and valuable of all, as the information can be used in any country and by the aid of very ordinary maps and charts. To those who object to taking the trouble to do this, let me suggest that other entomologists will there take up our work after we have followed Harris, Fitch, Riley, and more recently, Lintner and Maskell, on that long journey from which none return. We cannot, now, see what problems those who are to follow us may have to solve, nor can we determine the nature of the data that will be required for such solutions. Then, too, the foreign entomologist has frequently to turn to us for information regarding the distribution of both species and genera, and it is but justice to our fellows if we present our data in a manner that will be most intelligible to them. Some very good collectors, and not all of them American either, have overlooked this matter, and as a consequence we are sometimes left in the dark where we most needed light, and our colleagues really intended to supply it to us.

Altitude will not come amiss when you go over your notes, possibly twenty years hence, while food plants, food habits, relative abundance, and, indeed, almost any facts relative to the "sociology" of a species will be sure to be of use sometime, for someone. I am continually using data secured ten, fifteen, or twenty years ago, some of it at the time seeming to be hardly worth recording, but it is surprising how many good things

in the way of specimens and facts we are continually turning up, by accident, as it were, oftentimes not realizing the full value of our "find" until years afterwards. A careful, faithful observation is never without value, as it either brings a new fact to light or else substantiates an old one. Insects do not necessarily act alike over the entire area of their distribution, and the man or woman who uses their own eyes is almost sure to see something that has not before been observed. Why! I have gone to your fellow member, Mr. W. H. Harrington, again and again for facts regarding some of our insects that I have been observing for years, but he, with his close observation, has observed things that, if they were to be seen in my locality, were overlooked by me. We do not see everything going on about us, by any means, even we that are most in the field, and I have gone several hundred miles from home, and found certain insects there doing certain things that they were not observed to do at home, but as soon as I returned they were found to be engaged in precisely the same way that I had observed them elsewhere, and probably had been doing so all the time, but I did not happen to be a witness to the fact.

Of late we are hearing much relative to life zones, and, while it is hardly probable that we have at the present time sufficient definite information regarding the exact localities of occurrence among insects to enable us to say much in regard to these, as it is very easy to say too much, yet we all know that our species are not all of them generally distributed. Almost every collector will get species in his immediate neighborhood, sometimes in abundance, that are to be found rarely, if at all, elsewhere. There are certainly areas, over which a certain species will be found to occur in a greater or less abundance, while a few miles away it will appear to have given way to another. In almost every locality there is sure to be some particular spot that will be found especially rich in insect life. These favored spots may be a bit of woodland, a bank, a shaded ravine or a secluded valley, to which one can go with the assurance that he will secure something rare or new. The vegetation here may not differ materially from that of hundreds of other places, seemingly equally favored also by climate and elevation, yet a greater number of species seem to have gained a foothold, so to speak, here than elsewhere, and, somehow, are able to retain their hold. Just why this is true is not exclusively an entomological problem, but involves animal and vegetable life as a unit, and the insect collector can, if he will, pile up facts that will go a long way toward the settlement of problems not at present considered in connection with entomology at all. In other words, before we can do much with mapping out life zones, we must have a vast amount of information that can only be secured by the careful collector and observer. Not only must this data be secured, but it must be made available by being placed on record where it can be found by the great army of scientific men and women. I am well aware that there is in some quarters, an aversion to publishing detatched notes and observations and a tendency to hold fast to all such until a mass of material is thus secured sufficient for an extended and exhaustive discussion, but it has always appeared to me in a different light. Let us suppose that the science of entomology is an immense vase, as large as Ætna or Vesuvius, and this is shattered into fragments and scattered over the face of the earth, and entomologists, without definite knowledge of its original form or dimensions, are set to work to gather up these scattered fragments and reconstruct the vase. The fragments will of course be of every conceivable size and form and when brought together fit into each other perfectly, but many of them will be much alike in form so that the misplacing of a fragment will not infrequently occur, the mistake only being discovered by the proper one being found and fitted into place. A fragment may include a species, or any fact connected with its life history or habits. Now, let us suppose that a collector in Canada or elsewhere discovers a new species, while an entomologist in some distant part of the world discovers an allied form. Here are two fragments of science, separated, how widely we cannot know, until the intervening space has been filled in by collections, breedings and observations carried on by perhaps a dozen different individuals, possibly speaking half as many different languages, each contributing his fragment that is to fill in the space that divides the two forms and cements the two together, so to speak. Let me illustrate again, taking this time *Diaspis amygdali*,

which has recently been discussed by Mr. Cockerell, Mr. Tryon, Mr. Lounsberry and myself, each presenting some new phase of its habits in various parts of the world. But one of my contributions related to a parasitic foe, described by Dr. Howard and reared by myself from the Coccid just mentioned, on trees recently imported from Japan, and also by Professor Marchal in Paris, Mr. E. E Green in Ceylon, the late Mr. W. M. Maskell from Coccids received by him from Sydney, New South Wales, and at the United States Department of Agriculture, from an Aspidiotus from Georgia. Here we have fragments of our imaginary vase gathered from all quarters of the globe, not only fitting into the Diaspis fragment, but into others as widely separated as well. But suppose each one had kept his fragment to himself until such time as he could secure sufficient material for an exhaustive paper; how long would each have stood in the way of the other in attempting to make use of his information? "Rushing into print" is not to be commended, but a collector owes it to his fellows, and to entomology in general, to collect carefully and make all possible observations in connection with his material, placing the former on record for the benefit of his colleagues. The value of such work as is being done by Messrs. Harrington, Kilman, Bean, Fletcher, Lyman, Fyles and other Canadian entomologists, is not to be measured by our present knowledge, nor are the facts gained by these gentlemen to be taken separately, for, individually, they may be nearly or quite worthless and yet contain the very missing link that some other worker is hunting for, and through the lack of which he is unable to proceed in the solution of his own problem. Isolated from his fellows, working for the love of nature with little or no encouragement from those about him, it is not to be wondered at that a collector should think only of himself and his individual pleasure, becoming satisfied with dried corpses pinned in his cabinet and caring nought for the habits of these forms of life when active. But there is a world of riches at the door of every collector, isolation frequently becoming a blessing in disguise, for if he will but keep his eyes open and tell the world what he sees, he will ere long be surprised at the wealth of facts that he will accumulate.

The unknown in entomology may be likened to an ocean whose shores are lost in infinity, while the known is as a mill pond. There is so much to observe, so much to learn and life is so short. The collector, more than any one else, has opportunities for observation such as, if made with care and accurately recorded, may outweigh volumes of compilations that are too frequently permeated by the opinions of men, while original observations come direct from the hand of the Creator.

In conclusion, then, if there is any kind word of encouragement or of admonition that I can offer to the collector, whether he be located in city or country, let me do so here. Gather up these fragments of which I have been telling you, as you would grains of gold from among the sands, for sooner or later there will be a mint open for their reception and you will be surprised at their value. You will be more than once astonished to find that what you took for a worthless, fragmentary observation, will really turn out to be the keystone of an arch which has long been unfinished for lack of your fragment.

ENTOMOLOGY IN SCHOOLS.

By Wm. Lochhead, Ontario Agricultural College, Guelph.

The Annual Reports of this Society for 1896 and 1897 contain several very suggestive papers relating to the study of insects in our schools. Ex-President Dearness dealt somewhat fully with the subject in his two Presidential addresses, and the late Professor Panton outlined a method of presenting the subject from an economic standpoint. These three addresses, I remember, gave rise to a discussion among the members present on those occasions, and showed plainly that the time was ripe for introduction of nature-study into our schools. The members were unanimous in the opinion that insect life should form a portion of the children's study, at least, in our rural schools.

Mr. Dearness deserves much credit for his efforts towards the introduction of nature-study in his own County of Middlesex, and, in a general way, throughout the Province of Ontario. It is to be hoped that a little leaven will leaven the whole lump, and that every County Inspector will endeavor to the utmost to further this most desirable object. The compulsory study of Botany in the lower forms of our High Schools has already paved the way to a partial recognition of nature study as one worthy a place in our school curricula.

As a teacher of science for several years in some of our largest Collegiate Institutes, I may be permitted to use whatever influence I possess in urging on this good work, and towards this object this paper has been prepared.

This paper will consider the subject under the headings *Why?*, *How?*, and *When?*, *i.e.*, why should teachers introduce the study of insect life into their schools? Supposing its introduction is a wise procedure, how should it be taken up? and when should it be taken up?

Why?

1. Because the study of insect life trains the eye to see, and the mind to draw proper conclusions from certain observed facts. The child learns clearly the relationship between causes and effects. It is remarkable the number of people who jump at conclusions without taking the time to relate cause and effect. Traditions and superstitions are still rampant, and many erroneous ideas of our forefathers are still too often accepted as truth in spite of the great advances that science has made during the last fifty years.

Pupils properly guided in their observations of nature will soon correct for themselves many of the errors that imperfect observers have made, and which have been handed down as truths. When the pupils have grown older, and have become engaged in the various pursuits of life, where alertness of mind, close observation, and accurate deductions count for much in the struggle for wealth, those who have been most carefully trained while young will, other things being equal, be most likely to succeed. It is a case of survival of the fittest in a struggle for existence. Comparisons, relations and judgment which are cultivated by a proper study of insect life are indispensable to the successful farmer, merchant and statesman. "If the farmer's boy learns how to accurately observe the process of nature with which farm produce deals, and the foes with which agriculture has to contend, are not the chances vastly increased that he will be successful in managing nature so as to get the greatest favors from this coy mistress of his life and fortune?"

2. Apart from the direct bearing on a successful life from a commercial standpoint, the study of nature reveals beauties and wonders all about us. Our eyes are opened to the wondrous transformation of insects, to the inter-relationships which exist between plants and insects, and among insects themselves. These are subjects of perennial interest, and the persons who have observed nature carefully will find in her not only "a resource and recreation, but an ever-faithful friend holding out comforting arms to those who are weary in soul and body." I think no one can be unhappy who has a true friend in nature, and can establish a living sympathy with everything about him, for Coleridge says:

> "He prayeth best who loveth best
> All things, both great and small;
> For the dear God who loveth us,
> He made and loveth all."

A writer with wide experience says: "The element of education which is at present most lacking in our common schools is the training of the powers of observation. The children need above all things else to be taught to observe carefully and correctly and to state their observations in clear and terse language. The ordinary child, whether on the farm or in the town, actually sees comparatively little in the world about him. The wonders of the trees and plants in park or meadow, of birds and insects flying about the house, float like shadowy visions before his eyes. "Seeing, he sees not." He needs a

teacher who can open his eyes and fix his mind on the realities among which his daily life is passed. This accurate observation of natural objects and facts is the only foundation on which scientific attainments can rest. The scientist is chiefly a man who sees better than his fellow men. But it is also a great help in practical life.

3. "No branch of science means more in actual dollars to the people of the country than Entomology. At least one-tenth of our crops is lost owing to the depredation of insects." It is surely a proper thing to instruct our children about the insects. They should learn to distinguish insects which are enemies from those which are friends. If our farmers and gardeners understood the method of dealing with the foes, and acted promptly and efficiently, the money value of this knowledge and action would equal the richest Klondike ever discovered. When Governments spend millions, and individuals risk their lives in opening up a mineral Klondike, it is not unreasonable to ask that more attention be paid to this insect Klondike at our doors. Let us educate the children to take an interest in insects, for in a few years they will have the control of the great money-producing areas, viz., the farms of our land. Dr. Fletcher has already treated of the value of Entomology from an economic aspect at a previous meeting of this society, and Mr. C. C. James, the Deputy Minister of Agriculture of Ontario, has also ably handled the subject in several addresses before Farmers' Institutes.

How.

Every good teacher will have his own method of presenting the subject, the one best suited to his own individuality, but there are general principles which he must follow:

1. As far as our rural schools are concerned, Entomology should be studied "without reference to systematic order or relationships." The whole study should be thoroughly informal in every respect; it should be natural. No stated lesson should be assigned as a task beyond the general collecting of insects which the teacher may ask to be done occasionally. At first the teacher will simply guide the pupils by adroit questions such as these: Where did you find it? What was it doing? On what plant did you find it? Did you see it fly? How did it fly? Did you hear it sing or chirp, etc. The difference in structure among insects brought before a class should also be studied by means of questions put by the teacher, the number of wings,

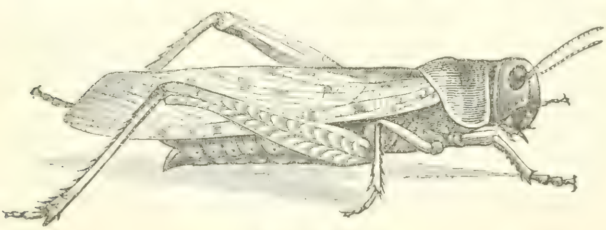


Fig. 25.

legs, and eyes, (Fig. 25) its mouth, and its breathing apparatus. The pupil will soon see that insects are unlike in many features, the observation of which will tend to increase his interest.

Fig. 26.

Occasionally injurious caterpillars will be caught in the act of eating leaves (Fig. 26); this occasion should be well used by the skilful teacher, and useful lessons learned. It is wonderful what a variety of insects will be forthcoming when the interest of the pupil is thoroughly aroused. Very often the best teacher will be incompetent to answer all the questions

asked him by the curious naturalists, but that should not deter him in his work, for even experts will very often tell of their ignorance in matters relating to insect-life.

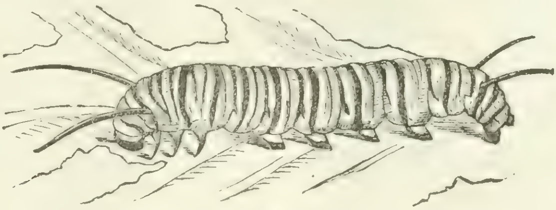


Fig. 27.

2. Encourage the pupils to make collections. Mr. Dearness has explained very clearly in his last year's Presidential address the simple method of collecting, so that every teacher who feels a living interest in this informal work, will find no difficulty in equipping both himself and his pupils with the necessary appliances.

Fig. 28.

3. Encourage the study of life-histories, for after all this part is the most important in every respect. The wonderful transformations should excite intense curiosity, and accuracy as to the observations forms one of the most valuable trainings to be obtained in any department of science. (See Figures 27-32).

Fig. 27, the caterpillar ; fig. 28, the caterpillar changing into a chrysalis ; fig. 29, the chrysalis ; fig. 30, the perfect butterfly.

Fig. 29.

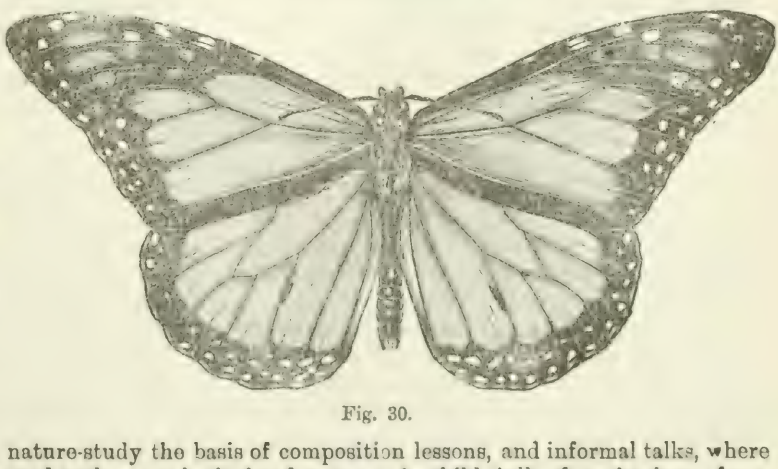


Fig. 30.

4. Make this nature-study the basis of composition lessons, and informal talks, where good English form and style must be insisted upon. A child full of enthusiasm for a subject cannot help but talk, and write too, if required to do so. Let abstract and foreign topics alone till his reading has become wider and his mind more fully developed

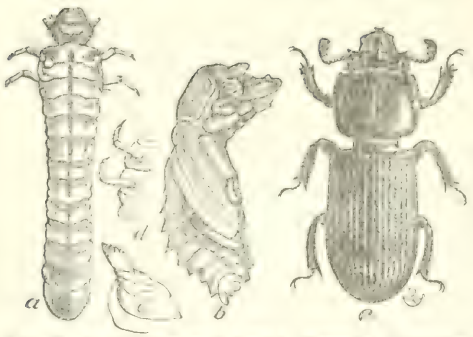


Fig. 31, grub, pupa and beetle (Passalus Cornutus).

The logical expression of the sequences in the development in insect life, if repeated frequently, will become one of habit, and will tell powerfully in many other ways. Not long ago the Principal of one of our largest Model Schools stated to me during a conversation, that almost invariably he could pick out the teachers-in-training under him who had received a science training in the High Schools. Science-trained pupils could develop a lesson along natural lines in proper logical order, so that they were thoroughly pedagogical in all their work.

5. Let the study of insects be one of relaxation from the more arduous duties of the school. The pupil must never have "Examinations" on the subject, else the knowledge of facts will soon be considered by pupils the chief aim of the study. Even the observations to be made must be incidental, just as the questions must be informal.

The child mind craves for informal instruction along such lines, and "the school becomes a delightful place, and the teacher an angel of light."

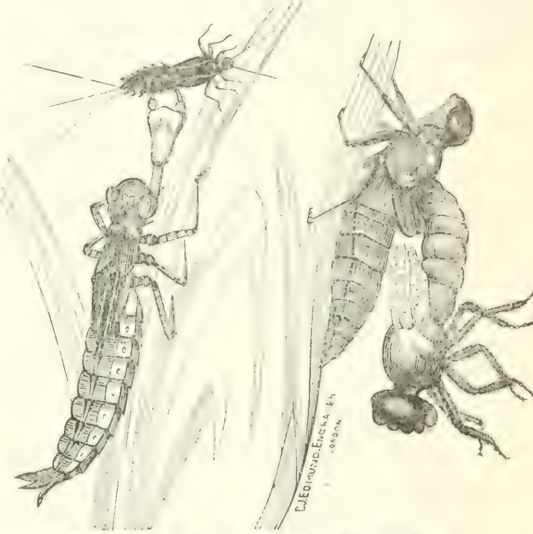


Fig. 32, transformations of a Dragon-Fly.

WHEN?

The amount of time allotted to this study should not be much. Let it creep in whenever the teacher feels that there is a need of relaxation, or when he has material for a good lesson. Some have advocated devoting a period to the work on Friday afternoons, but I would not limit the period to any particular time. It should not appear at all in the programme of studies. The youngest child is not too young to make observations and to try to give explanations.

TEACHER'S EQUIPMENT.

The greatest difficulty at the present day is to secure properly equipped teachers. This difficulty will gradually disappear as nature-courses are placed on the curricula of Normal and Model Schools, but a few words, I think, will not be out of place here regarding books with which the nature teacher should be familiar.

1. Comstock's *Insect Life*, published by the Appletons, is the best hand-book of suggestions, directions and methods for teachers that we have in America. Outlines of studies are given on pond life, brook life, orchard life, forest life and roadside life, while methods of collecting and preservation of specimens are sketched very clearly. Price $2.50.

2. Comstock's *Manual for the Study of Insects* takes easily first place as an Identification Book, and should be in every Entomologist's library. It contains keys to the

orders, and families, and gives brief descriptions and engravings of nearly all the commonly occurring insects. Price, $3.75.

3. Prof. Panton's *Insect Foes* (30c.) is a very convenient book for the busy man who would like to know the most injurious insects and the methods used in destroying them.

4. *Insecta*, by Hyatt & Arms, is a very neat and interesting book for beginners, and pays much attention to the anatomy of types from each of the orders. Price, $1.25.

5. Scudder's *Guide to Butterflies* and *Life of a Butterfly* are very useful books. The former pays much attention to identification of larvæ. Price, $1 50. Also Dr. Holland's *Butterfly Book*, with 48 coloured plates. Price, only $3.00.

6. Other special works are: *Williston's Diptera*, $2.25; *Cresson's Hymenoptera*, $3.00; *Leconte & Horn's Coleoptera*, $2.50; and *Banks' Neuropteroid Insects*, 50 cents; and *Packard's Works.*

7. In Economic Entomology there are Saunders's Classic Work, *Insects Injurious to Fruits*, price, $2.00; Harris' *Insects Injurious to Vegetation*; Smith's *Economic Entomology*, price, $2.50; Weed's *Insects and Insecticides*, price, $1.50.

8. Last, but not least in importance, are the *Annual Reports* of our own Entomological Society, in which will be found splendid accounts of the injurious insects from year to year. Every teacher should subscribe for the Canadian Entomologist, $1 00 a year; for in doing so he would get twelve monthly numbers of the Magazine and a copy of the Annual Report of the Society's Proceedings.

TWO AVIAN PARASITES: NOTES ON THEIR METAMORPHOSES.

BY R. ELLIOTT, BRYANSTON, ONT.

In the month of April, 1897, I noticed among the feathers of a Broad-winged Hawk which I was making up as an ornithological specimen several examples of a medium-sized fly that, judging from its peculiar structure, the faculty it possessed of passing rapidly through and hiding among the feathers, its reluctance to leave although provided with well-developed wings, must be a parasite, alive and well and quite at home.

Looking at a species of the highly organized order Diptera, in which the metamorphosis is complete, my first surprise at seeing the insect there soon merged into the second wonder: If the parasite remains for life on the host, and the metamorphosis is complete, in what manner is the routine of reproduction carried on? One could easily imagine eggs deposited on the feathers, an excellent environment to ensure development. But then, what would become of the larva? One could scarcely conceive of a maggot as living on the exterior of a living bird.

[In a Catalogue of Insects, under the family *Hippoboscidae*, I found *Olfersia Americana* Leach noted thus:—" Lives on *Bubo virginianus* and *Buteo borealis*."]

As the Broad-winged Hawk is a near relative of the last-named, is in fact *Buteo latissimus*, I assumed that I had found the name of the insect.

In September of this year, while manipulating a White-throated Sparrow for the same purpose as my hawk, I found another parasite fly, possibly of the same family, but of a different species from the first-named. It measured about five millimeters in length, with wings nearly, if not quite, as long as head and body, The thorax was flat and smooth; the skin leathery and tough; the legs (a light olive-green) long and

strong and provided with curved hooks—an admirable contrivance to enable the parasite to travel through the maze of feathers while the troubled host travelled through the mazes of the northern forest.

Fig. 33.
Foot of Parasite of White-throated Sparrow.

Through the kindness of my friend, Mr. Dearness, I am enabled to present herewith a drawing made by him under the microscope, which shows the structure of the fly's foot. (Fig. 33.)

The most interesting feature of the particular specimen described above lay in the fact that when found its condition gave me hopes that I might receive some light on its method of reproduction. Its abdomen was much larger in proportion than that of its congener found on the hawk.

Having placed the fly, living and uninjured, in a small phial, I watched and awaited developments. Within twenty hours I found the fly dead at the bottom, and a single large pupa (Fig 34) sticking to the side of the bottle. As it appears incredible that the young could have subsisted by itself in such a place, it seems reasonable to conclude that the egg and larval stages were passed within the body of the parent, thus accounting for two important phases in the course of its life. The pupa measured $2\frac{1}{2}$ x 2 millimeters, blackish brown, smooth and shining, flattish, oval, suggesting in form and outward structure some minute trilobite.

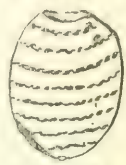


Fig. 34.
Form of the shining black pupa.

Mr. J. Dearness submitted the specimens of the two parasitic insects, and the curious larva, adding the following notes :

With the specimens submitted herewith, Mr. Elliott has afforded some of us our first opportunity of examining a pupiparous insect. He shrewdly suspected the curious fact in the life history of the insect under notice that the earlier metamorphoses take place in the abdomen of the parent, and that the young insect emerges therefrom in the pupal stage. The adhesiveness of the pupa, as shown by its sticking to the side of glass bottle, may be an important agent in keeping the pupa among the feathers during the brief time between its expulsion and its exit as an imago.

The only book I had at hand at the time of making these notes which relates anything of the Pupiparæ was Van der Hoeven's. Speaking of the Pferde-laus (*Hippobosca equina* L.) he says : "If we were told that a bird laid an egg that produced a young one at once as large as the mother we should think the account fabulous and ridiculous ; the fabulous part would not be diminished were the bird ever so small, or even a winged insect. Of this insect—the Pferde-laus—the story is actually true."

The smaller of the two parasites was the one that deposited the pupa in the bottle ; it is in the genus *Ornithomyia*, Latr., and is characterised by having distinct eyes, ocelli usually three, wings distinct, claws of tarsi tri-dentate. Hippobosca has no ocelli, and the tarsi are bi-dentate.

The author above quoted says of the family to which these insects belong that they lay no eggs, but are viviparous. That which seems to be an egg laid by these insects, and which is sometimes as big as the abdomen of the mother, ought to be regarded as a pupa. From it the perfect insect (imago) comes to view after an interval of time dependent upon the temperature to which the pupa is exposed.

A BIT OF HISTORY.

By J. Alston Moffat, London, Ont.

Early in 1898 the Rev. Dr. Bethune had received an enquiry from Mr. H. Bird, of Rye, N.Y., concerning certain specimens in the Society's collection. The Doctor naturally referred him to me. Shortly after I received from Mr. Bird a letter enquiring if *Hydrœcia appassionata* Harvey, was represented amongst the species of that genius in our collection. I replied that it was not, and that I suspected that there was but one specimen of it extant; and that one was in the the British Museum; and that a re-discovery of it would be a matter of very great interest; and this opinion I afterwards found was also entertained by Mr. Bird.

This *Hydrœcia appasionata*, Harvey, is a species that was taken at London, by Mr. E. Baynes Reed, and described by Dr. Leon F. Harvey in the August number of the *Canadian Entomologist* for the year 1876, page 155, under the generic title "Gortyna." The date of the description indicating that the capture had been made the previous year at the latest. There is no mention made of the number of specimens taken, or upon which the description was made; the presumption is, that it was a unique. At all events, a type specimen had gone into Mr. Grote's collection; Mr. Grote's collection went to the British Museum, and that specimen went with it, and there I presume it is now. It has generally been considered that some of the species of this genus are rather variable and run closely into each other. Reference is made by Mr. Bird in his paper (*Can. Ent.* Vol. 30, p. 130) to the difficulty that seems to have been experienced by the describers in deciding to which species certain forms belonged. Guenee is reported as considering *Marginidens* Guen and *Limpida* Guen as possible varities of *Rutila* Guen, whilst Walker regarded *Marginidens* as a doubtful variety of *leucostigma*. I have read somewhere a statement made by Dr. J. B. Smith, that as the genus then stood a specimen might be yellow or mouse-colored, with or without spots and yet be the same species. Dr. Smith had been convinced that the genus was in a most unsatisfactoy condition and wanted revision, and he undertook the task. The first thing to be done was to get as much material together for study as possible, so early in the year he requested the loan of the Society's specimens of that genus for comparison. I replied, that then they would have to be sent by express, and that he would remember that the unreasonable demands of the U. S. Custom officers had erected an effectual barrier to anything more being sent in that way. I sent to him a list of the genus as it was represented in the Society's drawers, and from these he choose those he wanted most to see, and they were sent to him by mail. Amongst them were three specimens which I had under the specific name "Rutila." One was from my former Hamilton collection. Another was taken by Mr. C. G. Anderson, of London, in 1895. And as it did not correspond to anything I could find, it was sent for determination and returned as "Rutila." The other was a specimen taken by Mr. Bice in 1896, of which he took several that season, and as I could not identify it, I sent it also for a name, which was also returned as "Rutila." This I considered was an illustrious example of the variability of the species, and quite confirmatory of Dr. Smith's statement already referred to.

In due time the specimens were returned with Dr. Smith's determination of the various forms attached to them. In his letter to me of August 15th, 1898, announcing his returning the specimens he remarks: "The specimen of *Appasionata* is the only decent example known to me in collections. *Circumlucens* is a new species of which there are only a few other examples known to me. So, though the lot was small it was not without interest." So there had been an example of the long lost *Appasionata* in the collection and I did not know it. This specimen of *H. Appasionata*, Harvey is Anderson's capture of 1895. *H. Circumlucens*, Smith, is the specimen from my old Hamilton collection, and "*Rutila*" is the 1896 capture of Mr. Bice. It would then appear as if "*Rutila*" had been a kind of general repository for anything that was known not to belong elsewhere. I believe there are two or three other specimens of *H. Appasionata*, Harvey in collections in London.

By my ordinary method of collecting fall moths, searching for them in the daytime, or beating bushes and weeds; all species of *Hydroecia* seemed to be rare and difficult to find, except *Nictitans*, which is more or less plentiful every season; whilst other species are obtainable only in single specimens at long intervals. In Mr. H. Bird's valuable paper on this genus (*Can. Ent.* Vol. 30, P. 126,) mention is made of *Nitela* as being a well known species; here it is seldom taken, and its variety *Nebris* has yet to be reported present. Referring to *Cataphracta*, Mr. Bird says: "At light the Imago would be considered a rarity." Here it is the most abundant form presenting itself at light. Dozens of it might have been taken in the season of 1897. It was less plentiful in 1898. *Inquaesita* would come next in point of numbers. This is an illustration of changed results in different localities.

THE GYPSY MOTH.

By E. H. Forbush.

Ever since the Gypsy moth exterminative work was placed under the management of the Massachusetts Board of Agriculture the plan of operations has been to work from the outermost limit of the known infested region toward the centre.

Obviously such a method, if properly executed, would best carry out the purpose of the State law, first, for the prevention of the spread, and second, for the extermination of the moth. In accordance with this plan it has been the policy of the Board to clear the outer towns from the moth and, at the same time, to reduce, so far as the money granted would permit, the number of the moths in the central towns. It was hoped that when the outer towns were cleared the force could largely be concentrated in the inner towns, clearing them also. If the Board had each year received the sums it has deemed necessary and annually requested this policy would by to-day, it is believed, have been carried on to complete success. But since the necessary legislative grant annually asked for by the Board has been cut down year after year from one-third to one-half, the moths have so increased in the central towns that they have been scattered into and have seriously threatened the towns cleared or nearly cleared in the outer belt.

Under these circumstances it has been found necessary during the seasons of 1897-98 to concentrate large bodies of men in the central towns to prevent a further wide dissemination of the larvæ into the outer towns; the outer towns, meanwhile, receiving less than their full share of attention.

The present year the full amount asked for ($200,000) was granted for this work by the legislature. Unfortunately the grant was so delayed that much of the necessary work of egg-destruction (by burning, before hatching time) could not be done. The heavy rains, too, which prevailed through May and June greatly hampered the spraying. Nevertheless, the burlap-work, which was done more extensively than ever before and over most of the territory known as infested, proved so successful that nowhere in the whole burlapped territory were any considerable number of trees stripped by gypsy moth larvæ.

We have also this summer done extensive burning, beginning in August; burning will be continued where needed.

On the whole, the granting this year of the full sum asked will make it possible for us to accomplish far more in 1898 than has been accomplished in any previous year.

While it is true that two colonies of the moth (one in Lincoln, discovered in 1897, the other in Manchester, discovered this year) are known, immediately outside of the limits of the territory hitherto defined as infested, these discoveries, under all the circumstances, do not in the least surprise me, since I have believed from the first that a few of such extra-limital colonies might confidently be looked for. Still these discoveries emphasize the necessity of far more inspection work outside the limits of known infesta-

tion. We have been absolutely unable in past years, with the money hitherto granted, to do nearly all that needed to be done in this line of work. This year as much as possible was done in this line, revealing, however, no infestation.

Efficient work has been done both in Manchester and Lincoln. The centre of the Manchester colony appears to be stamped out. Much work will be necessary in its immediate vicinity this fall and the country surrounding it must be carefully watched next year. The Lincoln colony has been brought to such a condition that there is little danger of dissemination from it.

Nevertheless the moth is scattered through hundreds of acres of woodland there and extermination in Lincoln and the adjoining town of Weston, into which a few larvæ have been dispersed, will be costly.

The work of spraying and burning the past season has been greatly facilitated by improved apparatus prepared under the direction of Mr. E. C. Ware, of the Department, and in part invented by him.

Information about the Gypsy moth has been widely scattered through the region adjacent to the infested territory. People have learned to dread the moth and are on the watch for it. The Lincoln and Manchester colonies were discovered and reported to us by citizens. To secure still further the intelligent co-operation of citizens in this work, it is planned to distribute from house to house, within the towns immediately bordering the infested region, an illustrated bulletin descriptive of the Gypsy moth, its habits and something of its history.

In no previous year have we been able to speak so confidently of progress so early in the season. The great wooded tracts, especially in the eastern, western aud northern divisions of the infested territory are now in excellent condition. More than ever this year have I been impressed with our power to cope with and in due time to utterly extirpate the Gypsy moth, when we are sufficiently supported by Legislative grants.

If the Legislature promptly provides for several years to come an appropriation strictly limited to the Gypsy moth work and equal to the amount granted this year, there can be no doubt of the final extermination of the Gypsy moth from Massachusetts.

Dr. Bethune, in commenting on the paper, said he had visited in August last the scene of operations of the Gypsy Moth Commission, and had been shewn all their appliances and methods of operation in carrying out the work of controlling and ultimately exterminating the destructive insect. He described the spraying of the foliage of tall trees with poison in order to kill the caterpillars, the scraping off and destroying egg-clusters, the burning by means of a hose discharging blazing kerosene of weeds and rubbish in rough localities which were known to be infested, and also the banding of trunks of trees with burlap. The apparatus employed was of the most perfect description and was largely the invention and product of the members of the force. He was especially impressed by the magnitude and thoroughness of the work; in traversing many miles of the State in different directions he noticed that every tree, large or small, whether in private gardens, public streets and parks, or woods and swamps, had its trunk wrapped round with burlap and a code mark painted upon it indicating the dates when it had been inspected. He felt sure that if the Commission is maintained with its present staff of workers the extermination of the insect will before many years be accomplished.

It was then moved by Mr. Dearness, seconded by Mr. J. D. Evans, and resolved: That the thanks of the Society be conveyed to Prof. Forbush for his interesting paper, and that this Society desires to place on record its admiration of the work done by the State of Massachusetts, under the able direction of Professors Fernald and Forbush, to restrain the spread of this most destructive insect, and if possible to exterminate it eventually. Had not such energetic measures been taken the consequences to neighboring States and even to our own country might by this time be appalling.

THE COTTON BOLL-WORM IN CANADIAN CORN.

BY J. DEARNESS, LONDON, ONT.

On the 10th of October Mr. E. T. Shaw, residing near Dorchester Station on the G. T. R., east of London, drew my attention to a larva which he said was damaging his corn by burrowing from the top downward between the rows of grain on the ear. I went over into the field—one of about four acres—and with his assistance soon obtained a number of specimens of the larva. I estimated that in the part of the field we were collecting them that about one ear in five was affected.

On taking the larvæ home I was surprised to find that it agreed exactly with the descriptions of the Cotton Boll worm (*Heliothis armiger* Hubn) and that in a Canadian latitude it could be so numerous as to possess an economic interest.

On making further inquiries I learned that the "worm" was reported in the corn-fields of most of Mr. Shaw's neighbors and indeed was said to be much more prevalent and injurious in a large corn-field of Mr. McNiven's than in Mr. Shaw's.

Last week Mr. Paul Hunter informed me that he had been husking corn in a field near Gladstone, Ont., a village in another part of the same township, and that "nearly every ear had a worm in it." He described the insect so well without any suggestions from me that I felt sure it was the same that had attracted the attention of the Dorchester Station farmers.

I visited Mr. Shaw's farm again on the 3rd instant (November) in the hope of finding some more specimens, the numbers of my first collection having been reduced by cannibalism. In confinement the larvæ seem to prefer the tissues of each other's bodies to the corn I placed in the jars with them. Possibly, indeed probably, they could not bite the rather hard shelled corn placed in one of the jars. In another jar in which two or three ends of ears of corn had been placed, when I returned after a week's absence only one specimen was living. Therefore, as just stated, I went last week to Mr. Shaw's to collect some fresh specimens to bring to this meeting. He happened that day to be hauling in unhusked corn. In the load just brought in we found relatively few affected ears, not more than one in twenty or thirty, but in the next load they were quite common, one in every two or three ears.

The affected ears usually had but a single larva in them, the largest number I saw in one ear was three. The damage done to affected ears by the burrowing and milling of the grain is not very great, less than five per cent., but some of such ears showed a mould that had made an entrance and was following the channel burrowed between the rows of the injured grains.

Dr. Fletcher informed me last night that a farmer near Orilla had reported damage to 75 per cent. of the ears of his corn by an insect which the doctor found to be the same species as the one under consideration. He will doubtless refer to it in his Notes of the Season.

The life-history of this interesting insect has been so well studied and so fully reported in the Fourth Report of the U. S. Entomological Commission and in subsequent bulletins of the Division of Entomology of the U. S. Department of Agriculture that but little remains to be done by Canadians. However its appearance here in the role above described may justify a brief synopsis of what has been recorded of its history and habits.

From the elaborate report of the Commission above cited we learn that in many parts of the Southern States the Boll-worm is regarded as more destructive to cotton than all other insects combined and that in some parts of the Southern and Western States it has been very injurious to corn. In the three years preceding the labors of the Commissioners they reported very marked damage to corn all through the South and West, it being a common experience to find fields in Virginia and southward in which almost every ear was pierced.

Glover, in 1866, wrote that a dissection of a female boll-worm moth showed that it contained about 500 eggs. Mr. F. W. Mally, who made an exhaustive study of this insect for the U. S. Division of Entomology obtained 687 eggs from one moth. The egg is oval in shape, whitish in color, and beautifully sculptured, fifty of them side by side would make a line an inch long. The eggs are laid singly on various plants, but preferably it would seem on the young silk of ears of corn. This preference is taken advantage of by the cotton growers who plant patches of corn here and there in the plantations to serve as a trap crop, the corn being harvested at a time when the planters think they will effect the maximum destruction of the larvæ. The egg hatches in 2 to 4 days. The larva which is variable in color undergoes well marked changes in its earlier moltings, some of these are noticeable in the specimens exhibited. The mature worm is an inch to an inch and a half in length and rather less than a fifth of an inch in diameter, the head is amber colored and the body is strikingly marked by a dark stripe along the back centred by a fine white line. On either side of the dark stripe on the back are paler ones and on the side a very distinct and whitish stripe in which the spiracles are found. On the sides are three or four rows of tubercles each bearing a rather stiff hair. The two legs (the six on the anterior segment of the body) are dark in color and the prolegs have each fifteen small hooks.

The first food of the young larva is its own egg shell, but it soon settles to work devouring the tissue of its host plant, whether that be cotton, corn, tomato or some other. In August it is said to pupate in about 21 days, and the pupal stage then to extend over two or three weeks. The last brood hibernates in the pupal stage. These remarks on the life history are condensed from Mr. Mally's reports.

The perfect moth like the larva is variable in color. It is fully described and well illustrated in the 4th Report of the Entomological Commission.

The series of specimens in our collections at London were taken by Mr. Moffatt, at Hamilton, some years ago. I do not find any Ontario record of it since until this year.

Although this year it is present in sufficient numbers to warrant the attention of the economic entomologist, I do not suppose there need be much apprehension on the score of serious injury in the future. The unusually prolonged season in Ontario may have permitted the development of an additional brood as compared with other years. Were it to remain and extend its area it would be most unwelcome as the question of remedy is obviously difficult. Its presence in the green ear of corn can be detected by an observant eye. When observed the tedious remedy of pinching or hand-picking might be resorted to. Obvious difficulties stand in the way of spraying with poisonous solutions.

After the members present had examined the specimens brought by Mr. Dearness, Mr. Dwight Brainerd reported that he had met with the insect in Massachusetts this year for the first time. Mr. Winn said that a few specimens had been found in Montreal and referred to the mention of the insect in Mr. Gibson's list of moths taken at Toronto. Dr. Bethune had found it this year also at Port Hope, where the larva burrowed into the fruit of the tomato.

MUSKOKA AS A COLLECTING GROUND.

By Arthur Gibson, Toronto.

In the month of August last I had the pleasure of spending two weeks in the "Highlands of Ontario," Muskoka, my destination being Port Sydney.

Port Sydney, with a population of about 50 inhabitants, is about 138 miles due north of Toronto, being situated at the southern extremity of Mary Lake, which is about 5½ miles long and 2 or 3 wide.

To a person who has never visited Muskoka, the Lakes which abound everywhere in that district, and which as a rule, are filled with numerous small islands, beautifully arranged, so to speak, and the mainland with its wild picturesque scenery, the sight tha meets the eye is truly wonderful, and worth going some distance to see.

In Mary Lake there are seven small islands of various sizes, one probably covering an acre or even two, while another would only contain about enough room upon which to build a fair sized house. These islands for the most part are composed of solid rock, with only probably a few feet of earth on the surface. In fact throughout the whole district there is nothing but rocks, rocks, rocks. On some of the islands there is a considerable growth of trees, shrubs etc, while others seemed to be quite bare. A curious sight often observed in the Muskoka country is large trees growing out of a crevice in what appears to be solid rock. To a casual observer there is considerable mystery in this, and as I have not looked into the matter, I am unable to throw any light thereon.

Certain rocks, on the islands, as well as on the mainland, sink, as it were, straight down into the water often to a depth of 30 feet and more. These rocks are not loose, in the ordinary sense of the word, but are a part of and joined to the mainland or island as the case may be, and often reach a height of probably one hundred feet or more. It will be readily seen, therefore that even the most delightful resorts, are not always the safest, but have their treacherous surroundings, and it is a wonder more drowning accidents do not occur throughout the many lakes that make Muskoka the attractive place it is.

From an entomological point of view, Muskoka ought to offer grand inducements to the collector, as vegetation in most places is simply in the wild state, and many good captures could no doubt be recorded. The month of August, the time of the writer's visit, is too late for general work, but for the collector of Noctuidae there should be a good harvest during that month, as there are numerous good places for "sugaring" purposes. About the 1st of July, I think, would be the most profitable time to visit Muskoka, as insects generally are most to be had about that time.

However, during my vacation at Port Sydney I noticed the following species of butterflies, viz Argynnis Cybele, Atlantis, Aphrodite and Myrina, all of which seemed fairly common, with Myrina the most plentiful. The first three named were mostly worn specimens, only a few of those taken being presentable Pieris rapae, Colias Philodice and Chrysophanus Hypophlaeas were also common. The latter was the commonest of all those noticed. Everywhere this little butterfly was to be seen flitting about, and the majority of the specimens were in good condition. A few specimens of Danais archippus (Fig. 30), and Grapta progne (Fig. 35), were observed, and of the Limenitis, disippus (Fig. 36) seemed fairly plentiful,

Fig. 35.

Fig. 36.

whilst but a single specimen of Arthemis came to view, no doubt owing to the lateness of the season. Besides these I noticed quite a number of specimens of Feniseca tarquinius, but could not manage to secure a single one. These interesting butterflies have a peculiar habit of flying anywhere but in the direction the collector is looking. They were all flying in close proximity to the alder bushes, on which their larvae feed upon a species of aphis.

Among the moths I took Catocala relicta and concumbens, also a few other noctuids, some of which were new to me, and I noticed the wings of Euprepia caja lying upon the sand, the body of which some enemy had secured.

Besides the above, some beetles were secured with the aid of the sweep net, but as everything was burnt up with the heat, nothing much was to be done. I did not take any notice of any of the other orders, so cannot say anything about them ; grasshoppers seemed quite plentiful, however.

Dr. Wm. Brodie of Toronto, the well-known entomologist, has, I believe, visited Port Sydney on several occasions and I understand has explored the neighboring vicinity. He stopped at a farm house a few miles down the Muskoka River from Port Sydney, the owner of which is an enthusiastic naturalist, his principal hobby being ornithology. In a conversation with Mr. Crew the doctor stated that during his recent visit during the latter part of June and first week or so in July he had made some interesting captures. One specimen of Euprepia caja was secured by him as well as another moth very similar to caja and probably of the same genus. Dr. Brodie spoke of the plentifulness of Limenitis Arthemis, and reported having taken quite a number of a Chrysophanus, which I understand does not occur at Toronto, and which appeared to be very common ; most of the specimens taken, however, were more or less in a damaged condition. Debis portlandia (Fig. 37) also appeared to be of common occurrence, the Dr. taking some 5 or 6 specimens. The habits of this butterfly are very similar to Neonympha Eurytris, which is our commonest representative of the "ringlets." On the whole the Doctor considered the past season to have been a poor one in the vicinity of Port Sydney, but I am satisfied that with a good season much interesting work could be accomplished there.

Fig. 37

The country to the north of Port Sydney and Huntsville which is about 12 miles from Port Sydney, contributes some fine specimens of insects. Mr. Tyers has received quite a large number of lepidoptera from the Muskoka region-about 25 miles north of Huntsville, among which are some very nice things in the Noctuidae, which are not included in our local fauna, and the majority of which have not, as yet, been identified.

No doubt there are new species yet to be found in that country, which has not, as far as I know, been worked up to any great extent.

RANDOM RECOLLECTIONS IN NATURAL HISTORY.

BY J. ALSTON MOFFAT, LONDON, ONT.

The aphidivorous habit of the larvæ of *Feniseca Tarquinius* has been well observed and recorded. The striking portraiture of a monkey's face in the form and markings of the chrysalid has also been commented on, and even photographed, yet no one can form a correct conception of its wonderful naturalness until they have seen it. But there is a habit of the butterfly which it at all times indulges in that I have not seen noticed in print, which is quite in keeping with the peculiarities of its previous stages, and, as far as I know, is unique. A favourite situation for this butterfly to rest on, either singly, or in groups, is the open side of a wood, or the leafy branch of a tree projecting into an open space. I have seen a single individual take its position on the extreme point of such a branch, and from there it would dart a little distance to the one side of where it had been sitting, then back to about as far on the other side of it, then back and forth a number of times before it returns to rest on its perch again. The distance it traverses in this movement may be about ten feet, and at right angles to the branch on which it had been sitting. It brings up at each end with a perfect snap, and a perceptible rustle of the wings. It seems to throw itself with great violence, and stop as suddenly, as if it had struck a board ; then off to the other end of its course and back again, to and fro with such rapidity that the eye can scarcely follow it ; then after a short rest it will repeat its performance.

Whether it is the male or female that indulges in this sport, I cannot say, or if it may not be confined exclusively to either sex. I had the good fortune to see the performance enacted three different times, in two of which the exhibition was brought to a fatal termination, but no attention was paid to the sex of the performers. I should be inclined to surmise that it is the male and he only.

When reading some remarks upon the parasitic worms of the genus *Gordius*, more commonly called "Hair Snakes," from the belief entertained by many that they are horse hairs transformed in water into snakes; the writer animadverted upon the ignorance and superstition that still prevailed on this subject, which was considered not at all creditable to the superior education of the present day; which brought back to my recollection something of the tedious process by which my mind was relieved of its ignorance in this matter, and set me a-thinking that if the writer had been possessed of some further information it might have tended to moderate his estimate of himself and others; for there are few erroneous notions in natural history entertained by the multitude, that have such a reasonable excuse for their existence, in nature and in fact, as this one about "Hair Snakes." And seeing that a knowledge of facts is a more certain way of abolishing both ignorance and superstition than the denouncing of either; and as it seems to me that there are extenuating circumstances connected with this subject that are not as well known as they ought to be, I shall give an account of what I at one time saw.

When I was a small boy living in the country, which was at that time "Backwoods," and having no playmates of my own kind, I naturally sought for companionship with other kinds; passing my time in the woods and fields in search of something new, curious or attractive to me, and especially in observing the works and ways of living creatures, in which I found my chief enjoyment. On one hot summer day after heavy and continued rain I was amusing myself in a pasture field that had never been cultivated: and in which were numerous little hillocks with hollows on one side of them, indicating that there, in the long-by-past, trees had grown, been uprooted and decayed. The hollows were filled with pure water from the recent and frequent showers. Their bottoms were smooth and bright green, whilst their clear and crystalline waters reflected every passing cloud that floated over them in the brilliant sunlight. Whilst dreamingly watching the rapid passing of small white clouds reflected in one of these pools, my attention was aroused by an agitation of the water at one side; and upon examination I found a tuft of yellowish white hairs, which had evidently come from some cow's tail, partially in and partially out of the water. The hairs may have been between eight and ten inches in length, and there may have been fifteen or twenty of them together. There was about two-thirds of their length in the water, and the rest on dry ground. The part of them that was on land was a compact mass, as if they had been plucked out together and dropped there; whilst that part of them that was in the water had each individual hair as widely separated from its fellow as it possibly could get, whilst each and all of them were animated by an undulating eel-like movement which they kept up incessently, as if they were making an effort to get off and could not.

I had seen *Gordius* before that, and upon inquiry had been informed that they were "Hair Snakes," from which I inferred that they were hairs turned into snakes; and here sure enough I thought I had found a bunch of them in the process of transforming; but how one portion of a hair could become a living snake, whilst the other part still remained a dead hair, was to me a perplexing and mighty mystery, and remained so for many years afterwards. In some of my promiscuous reading I at length came upon a satisfactory solution of the enigma. It seems that there is an animalcule of some kind that breeds in water, and is in the habit of attaching itself to objects floating in the water, and if these creatures are sufficiently numerous, and the object sufficiently pliable, they can by united action produce an undulating movement, and give to the object an appearance of individual life; and this is what I had seen. Not quite an ocular delusion, but a mental deception of the most convincing kind. I had noticed when looking at the hairs, that the portion in the water appeared stouter than the other, but I satisfied

myself with the thought that a living thing should grow; and in after years when I learned that an object in water appeared thicker than when out of it, I wondered if I had not been deceived in that way, but there was an apparent roughness of their surface which I could not account for, as I knew that hairs did not soften and swell in water; but what I had read explained most satisfactorily everything I had seen in connection with them.

If that tuft of hairs had been wholly in the water, and their full length endowed with motion as part of it was, each hair would have been moving independently of the others, and would likely have been scattered all over the pool; then in all probability my attention would not have been particularly attracted by them, further than to think that "Hair Snakes" were unusually numerous in that pool; and so I would have missed an instructive lesson, for what I read would not have impressed me as it did, but for what I had seen previously. This is an experiment that anyone favourably situated for obtaining the right conditions could easily carry out for themselves, and then they would have ocular proof of what a reasonable excuse there does exist for the belief that "hairs do turn into snakes."

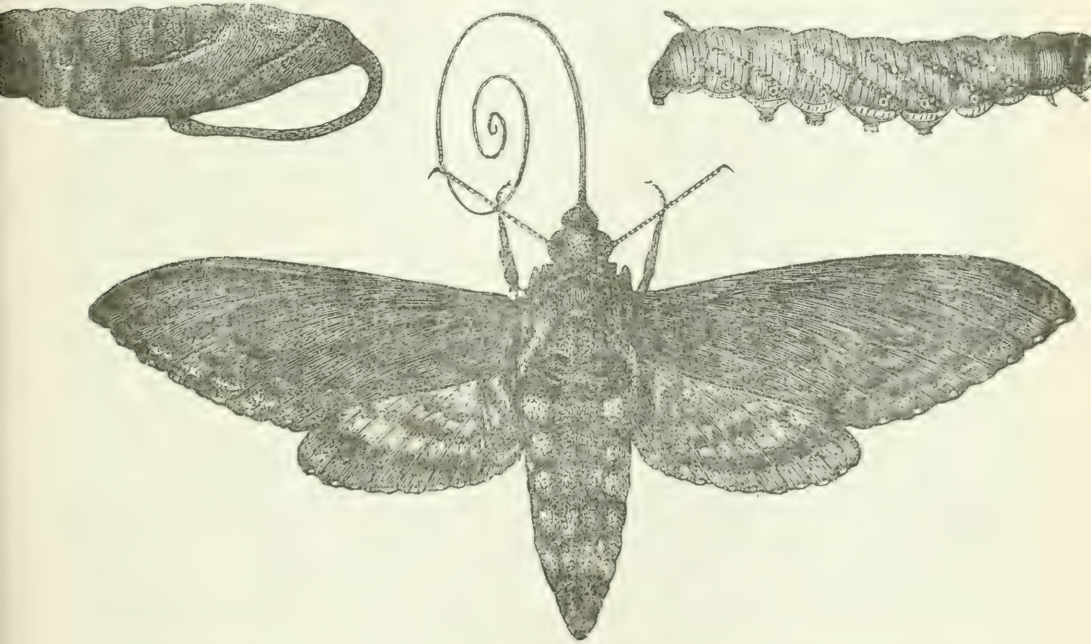


Fig. 38.

When engaged at one time in an effort to bring some chrysalids of the Tomato Sphinx (Fig. 38) to maturity, and obtain the moths, I noticed that one of them was dead, so laid it aside for a time. Upon my next handling it I found the outer skin dry and shrivelled, and upon removing a portion of it, which was an exceedingly thin and brittle scale, I saw that the moth within had been fully matured up to the point of emerging before it died, so finding that I had an excellent subject upon which to operate for discovering the position and arrangement of the various parts of the insect, as they were disposed of in the chrysalid prior to its assuming an active life, I commenced investigating. Carefully removing the outer covering, which came away as freely and as clean as if it had never been in any way attached to the corpse within, but upon which had been distinctly impressed every external feature of the coming moth, the matured pupa was disclosed scaled and coloured complete. The winglets, which were about three-quarters of an inch in length, pressed firmly—in what seems to be an unnatural position—on its breast, instead of on the sides where they are

to be afterwards; and the long legs compactly gathered together under the winglets, occupying the least space possible. The external loop on the chrysalid, in which the proboscis, or sucking tube, generally called "tongue," is partly contained, interested me the most, so I gave special attention to it.

Upon removing the outer scale of the loop—which has often been compared to the handle of a pitcher, and to which it bears a striking resemblance—I found that the proboscis within was double. It leaves the head and reaches about two-thirds the length of the chrysalid in the loop, where it touches and is united to the covering of the abdomen; here it is doubled back upon itself, not sharply, but with an open curve, which produces that knob at the lower end of the handle. It then presses closely to the under, or inner side of the descending portion till it reaches the head, where it passes inward to the body of the moth, whence it proceeds downward again, under the folded legs and winglets of the moth to its full length of four and a half or five inches, tapering gradually but perceptibly from base to apex.

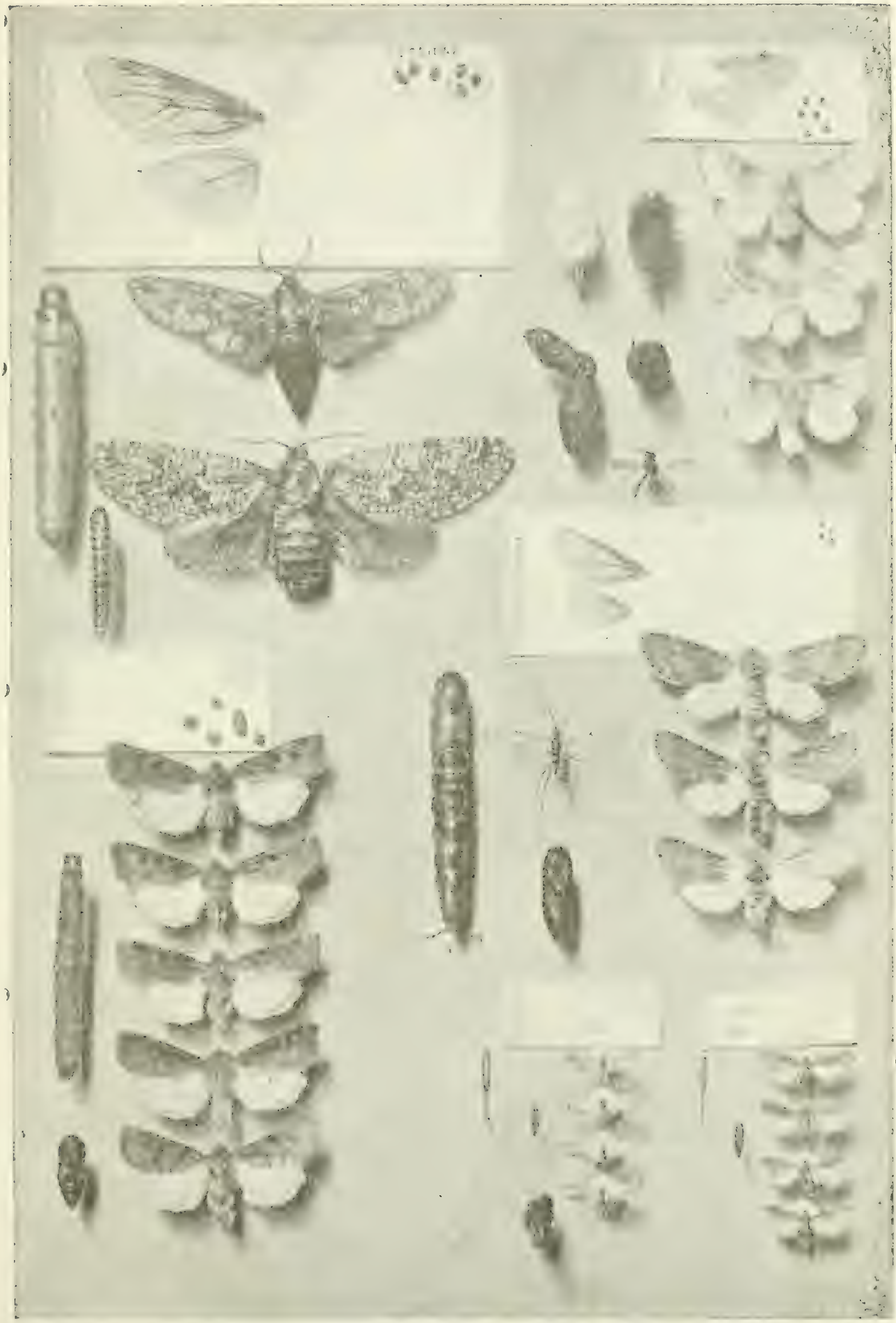
If such a chrysalid was broken open when newly transformed from the caterpillar, it would be found to be an unorganized fluid mass, seemingly held together only by the outer integuments—which parted so freely from what was inside, when matured—and upon which, even at that time, is imprinted all the external outlines of the coming moth, and from which the internal organical structure of the future solid body seems to radiate, and take on form and consistency. What a wonderful transformation is herein brought about by time and favourable conditions! From an unorganized fluid, to a diversified and complicated organism, adapted to a vigorous, active life. And the sucking tube, so delicately and yet so powerfully constructed, that the creature can extend it to its full length of five inches, or roll it up into a coil at its pleasure, not the diameter of a five cent piece. And yet more wonderful if we go back to the egg from which it all came, and within which lay "the power and the potency" for producing all that was to follow. "Never deviating from its course, but always producing a being like the parent." The proboscis is constructed of two longitudinal pieces with a groove on the inner side of each, which forms the cavity through which the moth takes its nourishment. These two pieces are firmly held together side by side by means of interlacing fibres, which yet admit of elasticity to the tube and allow the cavity to expand when food is passing through it, and may be used by muscular pressure in assisting to force it into the gullet. What wonderful adaptations of means to an end are to be observed in nature for the production of organs suited to the requirements of the creatures using them. One can at times see something like the exercise of the inventive faculty in evading or overcoming obstacles in the way of reaching the end required, when these are somewhat out of the ordinary, and with admirable success; impressing the mind with the thought that there must be somewhere, intelligent direction and supervision for the accomplishing of it.

THE PREPARATION OF SPECIMENS FOR THE EXHIBITION OF LIFE-HISTORIES IN THE CABINET.

By Dwight Brainerd, Montreal.

My brother and I arrange our cases in a rather peculiar way, and were complimented by being asked to describe it for the "Report."

The point that bothered us, was to break the lines ordinarily found in a drawer. We have four sizes of cardboard oblongs, cut proportionately, and use them instead of the common name labels. They are placed above each species, should be about half as long again as the wing span, and contain the bleached wings, frass and eggs corresponding to the name across their left hand margin. (See Plate).



Life Histories shewn in a Cabinet (D. Brainerd).

By this method, the drawers are cut up into little squares, each large enough to hold a series together with the caterpillar, ichneumons, etc. One can put a good deal of taste into the arrangement and the effect is certainly good. Outside of looks, I do not know that the system has anything to recommend it. Of course with white cards, the drawer covering must be colored : we employ a rough buff wall paper.

I am asked for some remarks on inflating and wing bleaching. Many books give instructions, but for novices it may be said that caterpillars are inflated or blown by slightly cutting the anal orifice, ventrally, squeezing everything out by the hole so made while holding them between the fingers in a soft cloth ; binding a tube in this hole and drying them, inflated by a current of hot air. It is well to have a piece of blotting paper to absorb the drop or two of liquid ejected when the cut is first made, and care must be taken to clean the neck. Neglect of this makes an ugly black blotch.

Benzine is the best thing for killing, as some kinds of caterpillars seem to fatten on chloroform. The stripping and drying should be done immediately the caterpillar is dead. If not, it draws up into all sorts of knots, and if left until relaxed, is too tender. Partially dry the skin before giving it much air pressure or it will get out of shape, and stiffen up the tail end before paying much attention to the head.

I never could make much success of the straw recommended by experts, and always use a glass tube drawn to a point to furnish the air. Lap it with silk three or four times, run slightly into the caterpillar, make a turn or so in front of the last pair of legs and fasten the silk back on the tube. With very small things, this glass can afterwards be cut off by a file, and a headless pin, bent at right angles, stuck in with a drop of gum. Larger species should be slipped off by the thumb nail and pinned through the middle.

The less heat used, the better will be results. A lamp chimney fastened horizontally on a metal coat hook, makes a first class oven. And a candle is the best source of heat as by snuffing it the temperature can be regulated. The flame should be kept at least two inches below the oven, and the segments you are working held over the hottest place. Druggists sell a double bulb inflator now, which is much better than the breath for giving the empty skin its shape.

In bleaching wings, to show the veins, the only suggestion I can offer is the use of wood rather than common alcohol for washing. The oil in it increases the transparency. If bleaching has not been described in past Reports, the wings are torn or snapped off close to the body, soaked a minute in alcohol, and then, to remove the color, in Labaraque solution. When clear, wash again in alcohol, dip in water and mount on a card.

THE BROWN-TAIL MOTH (*Euproctis chrysorrhœa*, L.).

By Dr. James Fletcher, Ottawa.

The specimens of the new pest of fruit and forest trees in Massachusetts which I am able to show to-day, have been kindly supplied for this purpose by Mr. A. H. Kirkland of the Gipsy Moth Committee. They consist of the male and female moths, the egg mass, the full-grown larva and the hibernaculum in which the larvæ pass the winter.

This insect is well known in Europe and has about the same range as the Gipsy Moth. Thirty years ago, when I was a boy, it was not an uncommon species for one season at Rochester, Kent, in the south of England, but I learn that it is now rare. The first notice of its occurrence in America was when Prof. Fernald announced that he had been working on it in Massachusetts in 1897, but it had been noticed by some for four or five years before that date. It is thought to have been imported with nursery stock perhaps as early as 1885. Early last spring it was sufficiently abundant for Mr. Kirkland to

point out to me several of the winter nests of the larvæ as we travelled from Boston by railway to Malden, Mass. Most of these nests seemed to be in pear trees. Prof. Fernald has published a bulletin on the subject, and also an extensive article in the proceedings of the last meeting of the Association of Economic Entomologists which was held at Boston. Both Prof. Fernald and Mr. Kirkland consider this insect as a serious pest and urge that drastic measures should be adopted to exterminate it. The latter writes under date, Oct. 5, 1898:—

"The Brown-tail Moth was not a severe pest here the past summer because of the thorough work done last winter in destroying the winter webs of the young larvæ. Where this was neglected the caterpillars proved quite a scourge and from these neglected spots no doubt the moths spread to no small degree in the flying season. The female, you will remember, flies freely. A hopeful feature is the parasite help. We found the pupae parasitised to quite an unexpected degree by *Diglochis omnivorus*, Walker, and by a few larger hymenopterous parasites. Of course, I have only two years' experience to go by, and from this as a basis no strong predictions can be made, but I should not be surprised to see this insect spread gradually over New England and become a pest of about equal rank with the Tent Caterpillar, perhaps worse. Since the female flies so well and is doubtless carried on gales of wind, I can see no prospect of exterminating the insect. While we know that the insect breeds well on many shade and forest trees, I doubt if it becomes a pest at any great distance from orchards."

Kollar, the Austrian entomologist, in his "Insects Injurious to Gardeners, Foresters, etc.," says of this insect which he treats of under the name of the Yellow-tailed Moth: "It may justly be reckoned among the most destructive insects of the orchard. The larvæ often infesting fruit trees to such a degree that not a leaf or fruit remains uninjured, as was the case in the year 1828."

The caterpillars have a very wide range of food plants including nearly all of the large and small fruits; they will also attack a great many of the common perennial plants. The favourite food seems to be the pear. Compared with the Gipsy Moth, as both the male and female moths fly easily, the Brown-tail Moth has greater powers of spreading. The life history of the species is as follows. The winter is passed by the partially grown caterpillars, which hatch in August and feed for about six weeks upon the upper surface of the leaves, stripping them of the skin and cellular tissue in the same way as is done by the Pear Slug, leaving the skeletonized leaves brown and dead. The winter shelter consists of several leaves spun together with silk, and a colony of the young caterpillars retires into this shelter in the latter part of September and remains dormant until the following spring. They revive again just as the buds are bursting and do much harm at that time, devouring the young leaves, flowers and forming fruit. When full-grown in June they spin light cocoons among the leaves, and the moths emerge about three weeks or a month later. The moths appear in July and the curious and beautiful egg masses covered with golden fur-like down may be found on the leaves during this month. They are elongated, depressed, and rounded above, more regular in outline than the egg masses of the Gipsy Moth, but like them protected by a densely felted covering consisting of the golden brown hairs from the anal tuft of the female. Not only are the caterpillars of this insect voracious feeders upon the foliage of many kinds of trees and plants; but they are also the cause of much annoyance from the stinging hairs of the larvæ and pupæ. This stinging is of much the same nature but more intense than that caused by the hairs of the species of *Halisidota.* Prof. Fernald states that many persons in the infested region suffered so severely as to require the aid of a physician and the irritation was so annoying to some of the Gipsy Moth employees that the chemist was directed to investigate the matter to discover the cause and to find out if possible an antidote. Prof. Fernald concludes his article (Bull. 17, New Series, U. S. Dep of Agriculture, Div. of Ent.) as follows. "The nettling of the skin may be caused by contact with the caterpillars, both old and young, or the cocoons, but in the latter case contact is not necessary, as the hairs from the cocoons are blown about by the wind. An English journal mentions the fact that travellers are often affected when the wind blows strongly from infested hedges along the side of the road."

By examining the specimens which I have here, it will be seen that the egg mass is about half an inch long by a quarter of an inch wide. The eggs cannot be seen under their furry covering, but they are round, of a golden color, and there are between 200 and 300 in a heap. The caterpillars vary in appearance during the different moults. The young caterpillars are described as of a dirty yellow color, with a black head and a black ring around the neck. They are thickly covered with hair and have four rows of black dots along the back. They are social in their habits throughout their larval life. From the first they spin a web over themselves, and as a leaf is destroyed another is attached to it by silken strands and gradually becomes part of the nest. The leaves attacked are also fastened securely to the twigs. The nest is never entirely forsaken; when the caterpillars get larger they sally out in search of food but return from time to time to their refuge. The mature larva (as exhibited) is rather a handsome creature, velvety black lined with brown and bearing on each segment tufts of golden brown bristles. Along each side is a conspicuous lateral interrupted white stripe with tufts of curious hair-like processes. On segments ten and eleven are spherical reddish yellow tubercles, one on each segment, similar to those found on the Gipsy Moth. These the caterpillars can elevate or depress at pleasure. The head is black mottled with brown, and the full-grown larva is nearly an inch and a half in length.

Kollar speaks of pupation taking place by preference upon damson trees, the caterpillars leaving apple and pear trees to pupate upon the damsons. He also speaks of the mode of pupation as follows: "After the last moult, which the caterpillars undergo either in the old nests under the new web or in the open air, they disperse over the different fruit trees in the garden. Pupation takes place in June; several again unite, roll some leaves together into a ball, make for themselves jointly a brownish web and become dark brown pupæ. There are from four to twelve in a ball."

Among remedies, this author recommends highly the collecting of these balls, which are generally found either on damson trees or, when these are not present, upon the lower branches of the trees which have been attacked. The Brown-tail Moth is a night flying insect which is very active at night, but sits quietly without movement during the day time. The four wings and thorax are of a snowy whiteness; the antennæ are golden brown, white above, and in the male widely pectinate. The abdomen is dark brown in both sexes, that of the female bearing at its posterior extremity a round mass of golden yellow hair, which entirely disappears by the time egg laying is completed, the component hairs having been deposited by the female over the mass of eggs as a covering.

The work which has been done in connection with the Brown-tail Moth is another instance of the grand service which is being rendered to the State, the Union and the cause of economic entomology by the Gipsy Moth Committee. The laws which have been enacted in Europe, and already in Massachusetts, show the necessity of attending to this enemy at once before it gets beyond control. It is well for the country that chance has introduced it within the area so well watched by the expert entomologists and officers of the Gipsy Moth Committee. The careful experiments which have been carried on by these gentlemen show that the destruction of the webs in winter and the spraying of trees when the caterpillars are active, supplemented with lantern traps, are effective means of keeping down the numbers of this insect, and, further, that if the matter is neglected we have in this new pest an enemy with great capabilities for spreading and doing harm, which should stimulate effort on the part of everyone living in the infested areas to do what is advised by the Committee promptly, so that, if still possible, so destructive an enemy may be prevented from spreading over a large area of country. The experience of some districts which were systematically worked by destroying the conspicuous winter shelters with the caterpillars inside them in 1897-8, is very instructive, for there were practically no moths in these districts last summer; but in adjacent places where no effort was made, the moths have increased to such an extent that these cleared districts will probably be re-infested and all the work will have to be done over again.

INJURIOUS INSECTS IN 1898.

By Dr. James Fletcher, Ottawa.

The crops of the Province during 1898 have not suffered generally from any unusual or even locally severe outbreak of injurious insects. There have been, of course, losses in all crops from the ordinary annually-recurring pest s; but the wide awake Ontario farmer now knows pretty well what to do or where to get the necessary information, when he notices an unusual abundance of an insect enemy. We may again be thankful for a season of good crops, and for the most part these were got in in good condition. The general results of the year are given concisely in the excellent Crop Reports for November, issued by the Deputy Minister of Agriculture, Prof. C. C. James. The only drawbacks of the season were exceptionally hot weather with drought in some sections in July and August and a rather wide-spread and almost unheard of frost in the month of July, which affected some tender crops. The autumn was long and fine, with no severe early frosts, thus allowing all root crops and fodder to pick up well.

Cereals.

The cereals throughout the Province have made an excellent showing. Owing to the increase in the price of wheat last autumn, a large area was sown to this staple crop. The hot, dry period referred to, although it ripened up some oats rather prematurely, produced wheat of exceptionally fine quality. Mr. W. Scott, of the McKay Milling Co'y of Ottawa, a large buyer of grain, tells me that he has not seen for many years wheat of such high quality as he has this year received from some parts of the Ottawa Valley, some samples running as high as 64½ lbs. to the bushel, without any sign of injury by the Wheat Midge or other insect enemies.

"Poor yields were exceptional, and large yields were common. The plumpness of the grain is frequently alluded to, in many cases the weight going over the standard, and as high sometimes as 63 or 64 lbs. to the bushel. Here and there only did correspondents complain of rust, midge, or other injury to the crop. The yield is 24 bushels per acre for Fall Wheat. . . . . The crop of spring wheat has been over an average in yield, and the quality is also good. The yield is 17.7 bushels per acre."—(November Crop Report, Ont. Bureau of Industries, p. 2.)

Barley yielded heavily, and the sample, for weight and color, has seldom been surpassed. I have not heard of any injury by insects.

Oats were in places light, and in some localities suffered from the attacks of the Grain Aphis, Wireworms, and Cutworms. The injury by the first of these was light. As is usually the case, the parasites which invariably accompany this plant-louse, increased in enormous numbers and the plague stopped. The parasite which did best service was *Aphidius granariaphis*, Cook.

Devastating Dart Moth. A rather bad attack of the Glassy Cutworm (*Hadena devastatrix*, Brace), Fig. 29, the caterpillar of the Devastating Dart Moth, occurred on the farm of Messrs. J. Yuill & Sons, at Carleton Place.

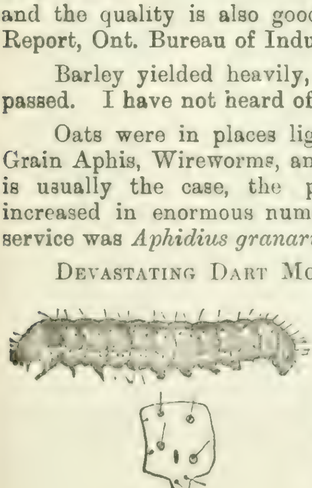


Fig. 39.

When insects attack a crop of grain it is always difficult to apply any remedy to the standing plants and the only resource is the practising of agricultural methods founded on the known life-history of the pest. Most insects feed upon closely allied plants; the wisdom, therefore, is apparent of following an infested crop belonging to the grass family with another consisting of plants belonging to a different botanical family.

Among the Cutworms, the two worst enemies of grain crops in Ontario are the species referred to above and the AMPUTATING BROCADE MOTH (*Hadena arctica*, Bois.), and although it is probablethat the latter of these may feed on other plants, the favorite food plants seem to be members of the Gramineæ or true grasses, upon the roots and lower stems of which they feed in a similar manner to the Glassy Cutworm.

This Cutworm is a more troublesome pest when it attacks grain crops, from the fact that the caterpillar does not become full-fed until some time later. In an attack of this kind it is, of course, necessary to examine the caterpillars to see how nearly they are full-grown. In the case referred to above the cutworms of the Devastating Dart Moth from Carleton Place were found to be full-grown by the end of the first week in June, and the owners of the field, who wished to sow their land again to oats, were advised that this could be safely done. The land was cultivated at once, and on the 8th of June was seeded down again to oats and grass. This crop was not attacked at all because the caterpillars were all in the chrysalis condition. This would not have been the case if the infesting Cutworms had been the caterpillars of the Amputating Brocade Moth.

Even less amenable to remedial treatment than the above are the various species of WIREWORMS (Fig. 40), which attack grain crops particularly on timothy sod. No satisfactory remedy for these has as yet been discovered. Sowing rye or barley on infested land has been found useful by some, and late ploughing is highly recommended; but no applications to the land or poisoning of the seed are of any avail.

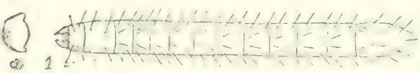


Fig. 40.

An interesting discovery has been made during the past summer at Toronto, by Mr. C. W. Nash, and at Norwood, Ont., by Mr. T. W. Wilkins, of a parasitic fungus belonging to the genus *Cordyceps*, which was in both places destroying the wireworms in considerable numbers. This fungus was much more slender than the one which is frequently figured as the parasite of the White Grubs (*Cordyceps melolonthæ*, Tulasne) (Fig. 41). So far, the identity of the wireworm destroying species has not been obtained. It is probable that it is an undescribed species.

Fig. 41.

THE WHEAT MIDGE (*Diplosis tritici*, Kirby), which a few years ago worked such havoc in the wheat crop, seems almost to have disappeared from Canada; however, one district seems to have suffered severely from this pest last season. This was along the shore of Lake Ontario in the Niagara peninsula. Another pest, which did not appear at all in 1898, is the American Frit Fly (*Oscinis carbonaria*, Loew.), which in 1890 injured wheat very much in the eastern portions of the Province. For three years before that it had also been an enemy of meadow grasses.

THE WHEAT-STEM MAGGOT (*Meromyza Americana*, Fitch), although present in most localities where looked for, seems lately to have gone back to a large extent to its natural food plants, the wild native grasses.

The most important attacks upon wheat, and these were by no means extensive or severe, were by the old and well-known culprits, the Hessian Fly (*Cecidomyia destructor*, Say) and the Joint-worm (*Isosoma tritici*, Riley).

Fig. 42.

The Hessian Fly (Fig. 42—greatly magnified) is probably more prevalent than it is generally thought; but as its depredations in most places are not serious they are not observed. The injuries to fall wheat in the autumn are greater than by the more conspicuous attack on the stem during the summer by the spring brood. Occasionally the spring brood attacks the wheat plants in the succulent root shoots just as is done by the autumn brood; this would be due I think to a late spring holding back the development of the wheat plants, The eggs would be laid on the leaves, and the young maggots might attack the shoots too severely to allow of them developing into stems. It has been frequently noticed that insects are not belated to the same extent as plants by cool spring weather,

The Wheat Joint-worm (*Isosoma tritici*, Fitch). (Fig. 43—the fly highly magnified). In 1895 specimens of injured wheat straws bearing many galls in the bases of the sheathing leaves of the stems were sent from Meaford, on the Georgian Bay, by Mr. Thomas Harris; these were considered to be *Isosoma hordei*, Harris. The injury to the infested crop amounted to 5 per cent. There was no recurrence of the attack last year at that place; but a somewhat similar attack upon wheat appeared at Verdun, Bruce Co., on the opposite side of the peninsula. Many specimens were sent to me by Mr. William Welsh, both in the autumn of 1897 and last spring. The galls were different from the Meaford specimens in that there was little swelling, and the cells of the larvæ were almost entirely in the tissues of the stem proper, short sections of which were rendered hard, woody, and brittle by the operations of the insects. From some of these stems a large number of the flies were reared. These have been identified by Dr. L. O. Howard and prove to be *Isosoma tritici* of Fitch. The injury was serious, attacked stems producing fewer and smaller grains than the others. From the Verdun material, in addition to the gall makers, two kinds of parasites were reared, *Homoporus chalcidiphagus*, Walsh, and *Eupelmus epicaste*, Walsh; but these were not present in sufficient numbers to affect the outbreak to any appreciable degree. During the past summer loss from this Joint-worm was not so great as in 1897, so it is to be hoped that its natural enemies may have increased. The eggs of the joint-worms are inserted into the young green straws in June by the female flies. Wheat, oats, rye and barley are damaged. There is only one brood in the year, a few of the flies issuing in the autumn, but most of them not till the following spring. Most of the galls are situated in the first or second joints of the stem above the root, and, as the normal time of emergence is in the spring, any treatment of the stubble such as burning over or ploughing down deeply, by which the insects are destroyed or smothered, must reduce their numbers considerably. Mr. Welsh noticed that many of the hardened portions of the stems were broken from the straw in threshing and were found among the rubbish or in the grain. These pieces from half an inch to one inch in length contain from five to ten larvæ. This shows that, besides treating the stubble, these pieces of stem as well as the straw must also be attended to. The broken-off hardened pieces should be collected at threshing and cleaning and burned. Likewise straw from fields where the joint-worms have been found should be destroyed by either feeding or some other means before the time at which the flies should appear.

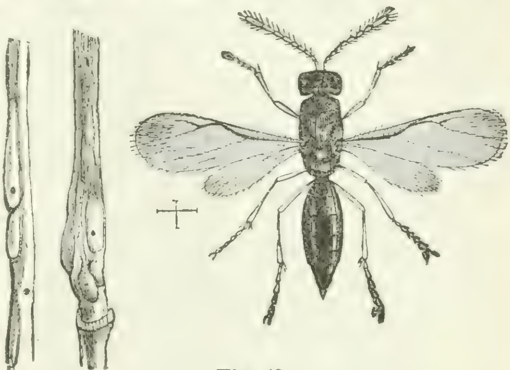


Fig. 43.

The Pea Weevil (*Bruchus pisorum*, L.). As in previous years many inquiries have come in for the best means to kill the "pea bug" in seed pease. The life-history is

well-known; the eggs are laid on the young green pods; the grub on hatching eats its way in and penetrates one of the forming pease. There it remains until full-grown, consuming the interior of the pea and passing through all its stages from a white fleshy grub to the chrysalis and then to the perfect beetle. A small proportion of the beetles emerge the same autumn and pass the winter under rubbish or in barns and other building. The larger number, however, remain in the pease and do not emerge until the next spring, so that they are frequently sown with the seed. The perfect insects fly easily and resort to the pea fields about the time the blossoms appear. They feed for some time on the flowers and leaves, and egg-laying takes place as soon as the pods are formed.

Remedies.—The best remedy for this insect is, undoubtedly, to treat the seed with bisulphide of carbon. Nearly all the large seed houses have special buildings for this purpose, and few seed pease are sold which have not been treated. Should it be found, however, when sowing pease, that they contain living weevils, it is an easy matter to treat them. Perhaps the most convenient way for farmers is to take an ordinary 45 gallon coal oil barrel. Into this 5 bushels of pease may be put at one time. According to the quantity of seed to be treated, use 1 ounce of bisulphide to every 100 pounds of pease; therefore, if the barrel is filled. put 3 ozs. of the chemical in a flat, open saucer or basin on the top, or pour it right on the pease; cover up the top quickly with a damp sack or other cloth and put some boards over that. Bisulphide of carbon is a colourless liquid which volatilizes readily at ordinary temperatures; the vapour which is quite invisible, but has a strong, unpleasant odour, is heavier than air, therefore sinks readily and permeates the contents of any closed receptacle. This liquid is very inflammable; so great care must be taken with it. The pease should be treated under a shed out of doors, and should be kept tightly closed up for 48 hours. No light of any kind must be brought near, or an explosion may occur.

The late sowing of pease is sometimes practised to avoid the weevil; but this plan is not approved of, as the crop is small and is then frequently attacked by mildew.

Seed pease may be held over without injury for two years, and this is a sure remedy against the Pea Weevil; for the beetles must emerge the first spring, and if the pease are tied up in paper or cotton bags, as they cannot eat through these materials, they will all be dead before the second spring. Weevilled pease should not be used as seed, as they produce, if they grow at all, weak, spindly plants.

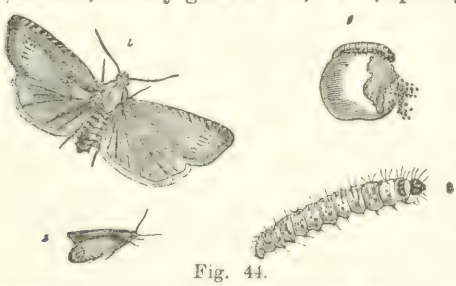


Fig. 44.

THE PEA MOTH (*Semasia nigricana*, Steph., Fig. 44). For many years pease in all parts of Eastern Canada have been much injured and sometimes rendered quite unfit for the table by the caterpillars of a small moth. The large, late garden pease have suffered most. Although its injuries were so considerable, it was only last year that the moth was reared and its identity determined. Maggoty pease are well known to the housekeeper; but it is only at intervals of some years that they are abundant enough to cause much complaint. The caterpillars are whitish and fleshy, with dark heads and some dark tubercles on the segments, from each side of which a slender bristle springs. When full-grown they are about $\frac{1}{4}$ inch in length; they then eat their way out by a small round hole through the pod and enter the ground a short distance, where they spin small oval cocoons in which they pass the winter, and the perfect moths do not appear again until nearly the middle of the following July. Dr. J. Ritzema Bos, in his Agricultural Zoology, says of the same or a closely allied European species: "The moths fly about in large numbers around the pea blossoms, always a short time after sunset. The females lay one, two, or at most three, eggs on a very young pod. In fourteen days the caterpillar is hatched, bores into the pod, and attacks the pease. The pease attacked are covered, while in the pod, with the coarse-grained excrement of the caterpillar and are often united, two or three together, by a web." The perfect moth is a modest-coloured but pretty species, $\frac{1}{2}$ inch long when the wings are closed, mouse-coloured, bronzed

towards the tips of the wings, silvery gray beneath. The only markings are along the front costa and at the apex of the fore-wings. The costal marks consist of 10 or 12 short, black streaks separated by similar clear white dashes; near the apex is a flask-shaped mark which bears 4 or 5 short, longitudinal, black dashes. Last year the attacks of the Pea Moth upon pease in Ontario were considerable, Mr. John McMillan, M.P for Huron, even putting the loss at one-third of the crop in his district.

Remedy—As a remedy, deep ploughing has been recommended. It has also been found that early sowing and the cultivation of early varieties enable the pease to mature before the moths are on the wing. The perfect insects have been reared both in 1897 and last season. In the former year all the specimens emerged between July 12 and 15, and in 1898 between July 13 and 15. These specimens were kept under natural conditions, and these dates probably agree with the time the moths appear naturally in the field.

THE BEAN WEEVIL (*Bruchus obtectus*, Say, Fig. 45). From time to time notices appear in reports of entomologists and in the newspapers in the United States of injury to seed beans by a weevil similar to the Pea Weevil, but rather smaller. This is the Bean Weevil, a small, very active beetle, at one time thought to be a native of America but now considered to be a cosmopolitan species, which has been imported into this country through commerce. Authentic instances of this pest having occurred in Canada in injurious numbers have not, I believe, been recorded until this year, when it was found at Strathroy, Middlesex Co. As in the case of the Pea Weevil, the Bean Weevil occurs in the seed and is sown with it. The eggs are laid on young forming pods and the grubs eat their way inside and attack the seeds. There is, however, one important difference in the life history, namely, the bean weevils are able to propagate in the dry, stored seed, and two or three broods may come to maturity and entirely destroy the beans, whereas in the case of the Pea Weevil the young grub can only begin life in the soft, green pease; again, there is never more than one weevil in a pea, while in the case of the Bean Weevil, ten, twelve, or more, may occur in a single bean, according to its size.

Fig. 45.

Remedy.—The remedy for this new enemy of the bean is precisely the same as for the Pea Weevil, viz, to fumigate the infested seed with bisulphide of carbon. If, however, it is found that the beans have been badly bored before the injury is detected, it is far better to destroy the whole by burning and procure new seed without going to the trouble and expense of fumigating.

FODDER CROPS AND ROOTS.

Fodder crops of most kinds have been remarkably heavy in most parts of the Province during the past season. In the Ottawa Valley such crops of clover have never before been seen, and with the exception of a little injury by the Black Army-worm, *Noctua fennica*, Tausch. in the spring, both crops were exceptionally heavy and were saved in the best of condition. In the west one or two occurrences of the Clover weevil (*Phytonomus punctatus*, Fab.) were mentioned but no appreciable effect upon the crop was made.

THE CLOVER-SEED MIDGE (*Cecidomyia leguminicola*, (Lintner) did a good deal of harm in the seed growing districts and some farmers speak of turning their attention to the Mammoth Red Clover and Alsike, because these varieties are not injured by this troublesome insect. The remedy of feeding off or mowing the crop before the 20th June has been found satisfactory by those who have tried it, because the maggots (Fig. 46) of the first brood mature and leave the clover heads to enter the ground and complete their changes soon after the date given, and if the clover is fed or cured before that date the larvæ are destroyed. If left later the maggots leave the clover heads and produce the second brood which matures just as the second crop, from which the seed is reaped, comes into flower. About the time

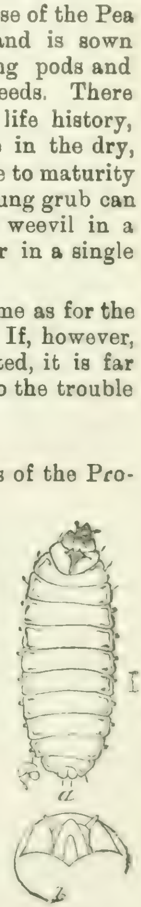


Fig. 46.

the seed is ripe these leave the clover and pass the winter in the ground, to emerge again the following spring just at the time the clover blossoms.

The hay crop has been little injured by grasshoppers or other pests. In old worn out meadows "Silver top," caused by leaf-hoppers and other sucking insects, has been noticed ; but well worked land with a good rotation of crops suffers little from this injury.

Potatoes have been less attacked by the COLORADO POTATO-BEETLE than usual. Early in the season some correspondents thought that this pest was dying out, but the hot weather of midsummer soon brought it up to its usual abundance. The well tried remedy, Paris green, in either wet or dry applications, is now too well known to require more than a reference.

Injuries by White Grubs and Wireworms were more serious than is often the case, and unfortunately little can be done to counteract their operations.

THE CUCUMBER FLEA-BEETLE, Fig. 47, (*Crepidodera cucumeris*, Harr.) which frequently does great damage to potatoes by perforating the leaves, has been successfully

Fig. 47.

treated again this year by spraying the plants with Bordeaux mixture and Paris green made with the formula 6 lbs. of copper sulphate, 4 lbs. of fresh lime and 45 gallons of water, to which ½ lb, of Paris green is added. This remedy is now becoming well known, and on account of its usefulness widely used by our wide awake farmers to prevent the loss which is still enormous from the ravages of the Potato-rot. The first spraying should be done in Ontario not later than the 1st August, and this should be followed by two more applications on 15th August and 1st September. These sprayings also, of course, render unnecessary the treatment of the potatoes for the Colorado Potato-beetle, as those insects are killed at the same time.

A rather unusual injury to potatoes was this year reported from Carrville, York Co., by Mr. J. Lahmer. This was by the FOUR-LINED LEAF-BUG (*Pœcilocapsus lineatus*, Fab.), and occurred at the end of May. The attack was, however, restricted in area and did not continue late into the season. The life-history of this pest has been worked out by Prof. Slingerland, of Cornell University. The eggs are laid in the terminal twigs of currant and other bushes in the autumn and do not hatch until the following spring. The bugs attack the leaves of the currant and some other shrubs to a certain extent, but are more injurious to various herbaceous perennials. The plants most often noticed as injured by this insect are Sage, Mint, Gooseberry, Currant, Dahlias, and the Japanese Honey-suckle (*Weigelia*), Potatoes and some other plants less frequently. It is hardly likely that this insect will ever prove a serious enemy of the potato crop. The mature insect is a bright greenish yellow bug three-tenths of an inch in length, with two black spots on the thorax and four stripes of the same color down the back. It is very quick in its movements.

Remedies.—As the eggs are laid in the twigs of bushes and are comparatively conspicuous, owing to the white tips protruding, wherever the bugs have been troublesome the eggs should be looked for and destroyed during the winter. The bugs and larvæ can be killed or driven away by dusting with pyrethrum insect powder, or by spraying with kerosene emulsion or whale-oil soap solution.

THE TURNIP APHIS OR CABBAGE APHIS (*Aphis brassicæ*, L.). Turnips in many sections have been badly injured by this plant-louse, which has been one of the worst enemies of root crops during the past season. Although much loss is due to this pest every year, as a rule, nothing is done by farmers to remedy the evil, many volunteering the information that nothing can be done. This, however, is not the case, for successful experiments have shown that, by spraying the plants bearing the first colonies which appear early in August, much may be done to protect a crop. At the time of thinning and hoeing turnips the colonies are small and may be easily treated by means of a knapsack sprayer with kerosene emulsion (one part to nine of water), or with whale-oil soap, one pound in eight gallons of water ; or even by hoeing out the infested turnips and covering them with soil, an easy matter at that time with the hoe in hand.

VEGETABLES.

Vegetables in gardens suffered locally from the usual pests of the garden, Cutworms, Flea-beetles, Onion, Radish and Cabbage maggots. For cutworms, banding freshly set out plants with paper or tin collars was quite effective; and for plants grown in rows, bran poisoned with Paris green was most effectual, either slightly dampened so as to make the poison adhere and then distributed in small heaps along the rows, or with more bran added until it was almost dry and then drilled along the rows. Flea-beetles (*Phyllotreta vittata*, Fab.) on radishes, young cabbages and turnips were speedily disposed of by dusting the plants with Paris green, 1lb in 25lbs. of perfectly dry land plaster. The ROOT MAGGOTS were unusually abundant and many experiments were tried to find a good remedy. Dusting Hellebore and Insect powder well down among the plants gave perhaps the best results with radishes and onions. For the cabbage maggot Hellebore 2 oz and Kainit 2 oz. were mixed in a pailful of water; about half a teacupful poured around the root of each cabbage after pulling away some of the earth, gave considerable protection but was not a perfect remedy. Kainit used alone, dissolved in water, or applied dry close to the roots of cabbages, onions and radishes and then covered with soil, or dusted on the surface close to the roots, had the effect of protecting the plants for a time, but did not give with me results sufficiently good to allow of its being recommended in the way some American growers have done. Last season, however, was an exceptionally bad one for all of the root maggots; radishes, onions and cabbages all being attacked severely from early in the spring until right up to the hard frosts of autumn. Kainit however is a quick acting fertilizer and a decided insecticide. Further experiments have been planned, and growers of vegetables can use it with advantage in ordinary years.

THE CARROT RUST-FLY (*Psila rosæ*, Fab). An attack upon carrots which has recently called for attention in Canada is by the European enemy of the carrot, called the Carrot Rust-fly. This has come under my notice occasionally during the last ten years in parts of Ontario, Quebec and New Brunswick, in all cases doing much harm in restricted localities, but as a rule disappearing after a year or two. The outbreaks, however, are, I fear, becoming gradually more numerous. During the past autumn infested carrots were sent to me from Knowlton and Beauce in Quebec Province and from Ottawa in Ontario. The attack is easily recognized. Early in the season the leaves of young carrots turn reddish and the roots will be found to be blotched with rusty patches, particularly towards the tip These carrots when stored for winter use, although sometimes not showing much injury on the outside, may be found to be perforated in every direction by dirty brown burrows, in which are many semi-transparent yellowish maggots about $\frac{1}{4}$ of an inch long. These maggots are blunt at the tail end, but taper toward the head, where is a black hooked tip, forked at the base, by which the maggot makes its way through the roots. The pumparium is reddish-brown, and the maggots, as a rule, leave the carrots before assuming this form. The fly and its work are shown very well in the figure (Fig. 48) by John Curtis, which I am able to present herewith through the courtesy of Miss Ormerod and Messrs. Blackie & Sons. The mature fly is two-winged, $\frac{1}{4}$ of an inch long, bright shiny black, with yellow legs and red eyes. The wings are beautifully iridescent. The winter is passed either as a maggot or in the puparium.

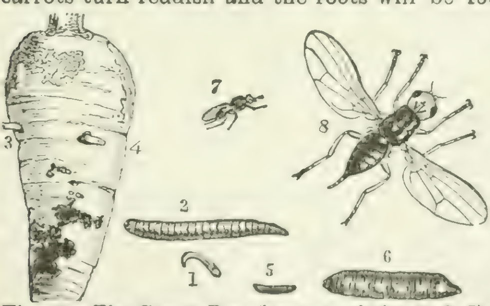


Fig. 48.—The Carrot Rust-fly—natural size (1, 5, 7), and enlarged (2, 6, 8).

Remedies.—The methods which have given the best results in preventing injury by the Carrot Rust-fly are (1). Late sowing. Carrots which have been sown late have been found much freer from attack than those sown at the ordinary time. When grown as a field crop it is usual to sow carrots as soon as possible, but for table use carrots of excellent quality may be obtained from seeding as late even as the middle of June. If field carrots grown for stock are only moderately attacked they can be fed but, of course, are not as

good as sound roots. (II.) Preventive remedies consist of applications of strong smelling substances by which the characteristic odor of the carrots is masked. For this purpose, sand tainted with coal oil or carbolic acid, has been used to good effect. Kerosene emulsion diluted 1 to 10 and sprayed along the drills by means of a knapsack sprayer, also gave comparative immunity. In localities where the fly is known to have occurred, the ordinary precaution of sowing carrots as far as possible from the infested land will occur to all growers Where carrots have been stored away during the winter in sand or earth, this soil should be treated to destroy the pupæ, which leave the roots and enter it to pass their pupal stage. A convenient method is to put the soil into a wet manure pit, or, if this cannot be done, it might be buried in a deep hole, specially dug for the purpose, and, after covering up, the top soil should be firmly tramped down.

THE CORN-WORM (*Heliothis armiger*, Hbn.). Several correspondents have complained of the unusual abundance this autumn of the caterpillars of what Prof. Lugger calls the Sweet-Corn Moth or Tassel Worm. These are both good names, but the insect is far more generally known as the Corn-worm. It is also the same as the notorious Boll Worm of the cotton, to which crop it frequently does great damage. Unfortunately, no very good, practical remedy has been discovered for application in the cotton field. The injuries of the Corn-worm are in Canada almost confined to the fruit of tomatoes and to sweet corn, particularly the late varieties. Late in October, Mr. C. L. Stephens, the Secretary of the Orillia Horticultural Society, sent specimens of the caterpillars and injured ears of corn, with the information that the caterpillars had been very destructive, injuring as much as 95 per cent. of the ears of both sweet corn and yellow field corn. It was a new outbreak in the locality, and was the cause of considerable anxiety. Specimens were sent also from Sombra (Lambton Co., Ont.), and two rather bad occurrences came under my notice at Ottawa. The caterpillars do not appear until late in the season. In the month of October they were found of all sizes eating the young grains of corn, mostly near the tips of the ears. There were sometimes five or six caterpillars in a single ear, many of which were rendered quite unfit for the table. As the larvæ approached full growth, they would occasionally eat their way out of one ear by a neat round hole and travel to another ear. They were very variable in color, from 1¼ to 1½ inches in length, of a pale-greenish or dark-brown color, marked with longitudinal dark stripes and with a conspicuous stigmatal band, white mottled with pink, the body bears the ordinary tubercles, which are distinct and black, each one supporting a slender bristle. The whole upper surface is marbled with white and the whole surface velvety, by reason of numberless and very short bristles, black and white in about equal numbers. When full grown, these caterpillars eat their way out of the ears and, entering the soil, spin cocoons, within which they change to chestnut-brown pupæ. This moth is by no means a common species in Canada, and all the specimens I have seen have been taken late in the year. Prof. Lugger states that the insect does not winter in Minnesota, but that all are killed late in the fall. This, he points out, would mean that the insect has to be re-introduced every summer from the South, where it can successfully hibernate. Whether this is also the case in Canada, I am not sure, but I think that some must with us pass the winter as pupæ. The moth, like the caterpillar, is very variable in color. It is usually of a pale, dull, ochreous yellow, with variable olive or ruddy markings on the fore-wings. The yellowish hind wings have a broad black band and are edged with pink. These moths expand a little more than an inch and a half. The caterpillars of the Corn Worm feed, besides, upon a great many other kinds of plants than those mentioned, such as pumpkins, tobacco, beans, peas and a large number of weeds and garden plants.

Remedies.—The only remedy which can be suggested is the hand-picking of the caterpillars. The destruction of the moths by lantern traps has been also recommended: these consisting of a lamp standing in an open pan containing water and a little coal oil. These traps are placed at night in fields where the caterpillars have been abundant. When an ear of corn is attacked, the silk shows the effect of the injury going on beneath the husks by being discolored prematurely. As soon as this is noticed, the leaves of the husk should be pulled back and the marauders destroyed. Fall ploughing will, doubtless, break up the cocoons and expose many of the pupæ to various enemies.

FRUIT CROPS.

Notwithstanding several adverse circumstances, the fruit crop of the Province was a good one, and satisfactory profits were realized. If the crop was short in one section it was abundantly made up somewhere else. "Notwithstanding all disadvantages, the returns from all over the Province, with the exception of a few northerly counties, show that the supply of fruit, more especially apples, was considerably more than sufficient for home consumption, very large shipments having been made to England and the United States from the western fruit growing section. Pears, peaches, plums and smaller fruits were also shipped from many localities." (*November Crop Report.*)

Insect enemies were the cause of much loss; but most convincing evidence was again given this year of the value of spraying, and undoubtedly one of the most instructive and interesting exhibits at the Toronto Industrial Fair was the display of fruit gathered from sprayed and unsprayed trees in the same orchard. These orchards were those in which Mr. W. M. Orr, the Provincial Superintendent of Spraying Experiments, had carried on his work during the summer of 1898, and were situated in twenty-four different localities. There were in all 250 plates of fruit. The owners of the orchards were in no way interested in trying to prove that spraying was or was not beneficial, but were practical men anxious only to know how to get the largest returns of money from their property. They would, therefore, be the very people to acknowledge poor results. The superintendent had nothing to do with the selection of the actual fruit shown, and did not see it until it arrived in Toronto, where he took charge of it and displayed it to good effect as a most convincing proof of the efficiency of spraying. At the last meeting of the Ontario Fruit Growers' Association at St. Catharines on December 2nd, 1898, Mr. Orr read his report on the results of the experimental spraying work carried on for the Ontario Government under his direction during the year. This is a most valuable document, and will be published in full in the Report of the Fruit Growers' Association. Mr. Orr explains his method of work and gives extracts from the letters of some of the owners of the orchards. In estimating the percentage of perfect apples, a part of the tree was picked clean and the fruit carefully examined; every specimen that had a worm or a spot, no matter how small, being rejected as imperfect. Some of the facts given and the figures which substantiate them will certainly convince many that spraying does most decidedly pay. The spraying must, however, be done properly, without stint of labour or materials, with the best obtainable apparatus and at the proper time. I am more and more convinced that failure to protect crops by spraying is due to lack of skill or carelessness in applying the spray, disregard as to the exact date when the successive applications should be made and misdirected economy as to the pump and nozzle used. Occasionally, good, careful fruit-growers find that spraying does not always give the results which they expect; Mr. Orr, however, says, "The owners of every orchard in which we worked this year, with one exception,—Mr. Curwen, of Goderich—report that the Codling Moth was largely controlled by spraying."

I give the following quotation from Prof. L. H. Bailey's recent pamphlet, "Impressions of Our Fruit-growing Industries," because it bears directly on this point, he says: "Does spraying pay? The past season has given strange results in spraying; in very many instances spraying seemed to do no good. Does spraying pay, then? Certainly, the same as tillage and pruning do. We do not know why there were so many unsatisfactory experiences in 1898, but this does not lessen the fact that bugs and fungi should be killed. That spraying pays is as well demonstrated as it is that apple worms, tent caterpillars and potato blight are injurious. Markets often fail, but it does not follow that markets are a nuisance. The surest way is to make it a rule to spray everything every year." (*Cornell Bulletin 153*, 1898.)

In summing up the results of the spraying work of the season, Mr. Orr said at St. Catharines: "It appears from results obtained in experimental work that from 65 p.c. to 80 p.c. of perfect fruit can be secured when spraying is regularly and properly done, and when the conditions are favourable, such as an orchard standing high and dry on well-drained land, away from buildings or hedgerows, and the trees planted far enough

apart so that the limbs do not come within 10 or 12 feet of touching, and have an abundance of sunshine and free circulation of air. It is also important that the trees be properly trimmed, all rubbish removed, and the land properly fertilized, for it is a fact that two-thirds of the orchards in Ontario are starving. With good apples at the price they have commanded this year and last, the orchard, if properly attended to, would be the most profitable part of the farm."

If the fruit-growers of Ontario, generally, can be made to appreciate the above statement of Mr. Orr, who is a practical fruit-grower, and will follow his advice, enormous advantage must accrue to the country from the good work which the Provincial Minister of Agriculture, the Hon. John Dryden, has done by having the spraying experiments and other work on injurious insects carried out. In fact, it is hard to find in the whole Provincial expenditure anything which has given such manifest and quick returns for the small amount of money expended. The great interest which was taken in this work of spraying is shown by the fact that over 3,500 fruit-growers attended the meetings when the spraying was being done, in order to see the work, to ask questions and to learn the the proper way to carry on operations for themselves. This was almost double the number that attended two years ago.

Spraying with arsenical poisons, such as Paris green, London purple, arsenate of lead, etc., was done, first of all, to lessen injury by the Codling Moth on the apple, and by the Plum Curculio on plums and cherries ; but it is now used against all foliage eating insects. It has lately also become the custom to spray many plants with a combined mixture which will destroy both insect and fungous pests. For this purpose, the best mixture known is Bordeaux mixture and Paris green. The formula most widely adopted is one which is very easy to remember, as all its parts contain the figure 4. It consists of copper sulphate, 4 lbs., quick lime, 4 lbs., Paris green, 4 ozs., water 44 gallons.

Owing to the large amount of capital necessarily invested in and required to operate a fruit farm, and the permanent nature of fruit plantations, more attention has been given to those causes upon which failure and success depend than has been the case with ordinary farm crops, which change from year to year ; consequently, more perhaps is known and more enquiries are received with regard to orchard pests than any other class of insects. The common enemies which occur year by year in orchards have been treated of over and over again in our annual reports, and there would be no advantage in speaking of them now at any length, but attention may be drawn to some of the more serious or unusual outbreaks.

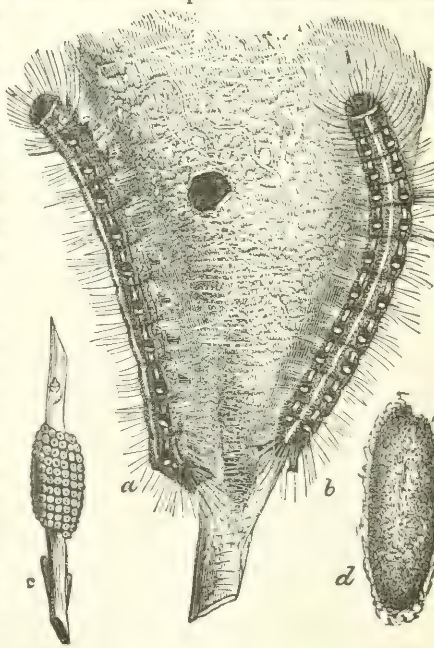


Fig. 49.

Tent Caterpillars have been even more abundant than last year in almost every province of the Dominion. In the Ottawa district groves of basswoods, maples, and aspens were stripped of every vestige of foliage, as well as the underbrush, consisting of numerous kinds of shrubs. Although the Forest Tent Caterpillar was slightly more numerous, the American Tent Caterpillar (Fig. 49), it was noticed, occurred with it in almost equal numbers, and, notwithstanding that close search was made for parasites, in this district at any rate, few were found. A large number of egg clusters were collected to see if the young caterpillars contained in the egg were in a healthy condition. These were kept in a warm office, and by the 1st of Januaryhundreds of young caterpillars had hatched and were gathered together in a large mat-like cluster on the side of the jar.

There is no indication of the presence of either egg parasites or fungous disease, and as the trees throughout this district bear enormous numbers of the egg clusters, the outlook is ominous; special effort must be put forth by fruit growers and gardeners during the present winter and next spring, or there will certainly be serious loss next season. The remedies which give the best results against these insects are (I.) the collection and burning of the egg cluster during the winter, (II.) the cutting off and burning of the nests of young caterpillars early in spring, when they may be easily detected by the conspicuous white tents which they spin in the crotches of branches, and (III.) the spraying with Paris green of all trees liable to be invaded in an infested district. The sooner the application is made the more effective it will be, for many insects which can be controlled while young are much more difficult to poison after they have reached a certain size.

THE APPLE APHIS (*Aphis mali*, Fab.) appeared in large numbers early in spring, and many enquiries were received about it from the western part of the Province. Little harm, however, was done either in the spring or late in the autumn, when most of the damage due to this insect generally occurs.

THE PLUM APHIS (*Aphis prunifolii*, Fitch) was less abundant by far than last year, although reported from a few places. Specimens of another plum aphis, (*Hyalopterus pruni*, Fab.,) were received from one or two Ontario localities.

THE BLACK CHERRY-TREE APHIS (*Myzus cerasi*, Fab.) was certainly less wide-spread in the Niagara district last season than in 1897, and reports concerning it were very contradictory; nevertheless considerable damage was done, particularly in orchards of sweet cherries. It has been noticed that the dark-coloured plant-lice are more difficult to kill than the green ones. Of several remedies which have been tried, the one which has given the best results is whale-oil soap solution, one pound of Good's Caustic Potash Soap No. 3 in six gallons of water, applied warm as a spray. Kerosene emulsion, also an excellent remedy, must be used as strong as one part to six of water for these plant-lice. The eggs of the Black Cherry-tree Aphis are laid upon the twigs, particularly on the fruit spurs, by the last autumn brood. There is no doubt, therefore, that good work could be done by spraying the trees during the winter, or better still, early in spring before the buds burst.

Another enemy of the cherry, as well as of the plum and pear, which when neglected did much harm was THE CHERRY AND PEAR SLUG (*Eriocampa cerasi*, Peck). The remedy which gives the surest relief is the prompt spraying of the trees with Paris green, one pound in 200 gallons of water, adding in all cases an equal amount of fresh lime with the arsenical poison, Paris green, to counteract its caustic effects on the foliage.

THE GREEN FRUIT-WORMS.—The caterpillars of three very similar moths belonging to the family *Xylina* did much injury to apples and pears, attacking specially the young fruit. These caterpillars are not regular pests of the orchard, but appear in numbers at long intervals; but, as they have a special taste for the green fruit, attacking it in preference to the foliage on fruit trees, the damage they do is much more important than that done by many other injurious insects. In addition to fruit trees they attack maple trees. At Niagara and at Aylmer, Que, near Ottawa, shade and forest trees, particularly the Silver Maple *Acer dasycarpum*, Ehrh.), were terribly disfigured and almost defoliated by these caterpillars over large areas. It was pleasing to see at the end of June that thousands of them were being destroyed by various insect-eating birds, chiefly warblers, but especially by the English Sparrow. In the streets of Niagara they were so vigorously assailed by the sparrows in the branches, and by chickens which waited for them below, that few could have escaped to complete their changes. Mr. Orr writes of the occurrence of this pest in the Niagara peninsula:—"The Green Fruit-worm, a comparatively new comer, and but little known here, is likely to become a serious pest: some growers reporting from 20 to 30 per cent. of their apples and pears ruined by it. By the middle of June it had destroyed much fruit."

Mr. N. H. Cowdry also writes of its depredations on the fruit of apples and pears at Waterford, Ont. The same complaint came from Mr. J. A. Link, of Sombra, Ontario.

Remedy.—The only remedy is early spraying, while the caterpillars are small and while they are feeding on the buds and young foliage. Luckily for the fruit grower these caterpillars are always accompanied when in large numbers by parasitic enemies.

The Rose Beetle (*Macrodactylus subspinosus*, Fab.), Fig. 50.—This well-known enemy of the fruit grower, which every year does so much harm by eating the flowers of grapes, apples, pears, roses, plums, raspberries, blackberries, and in fact all plants belonging to the Rose family, as well as many other kinds of trees, did some harm this year in the hotter western sections of the Province. It occurred in large numbers near Niagara upon the young fruit of apples, in some cases actually covering the fruit. There is only one brood of this pest, the mature beetles last for about five weeks. There is perhaps no fruit insect known more difficult to combat than this is. The ordinary insecticides have little effect on it. Covering rose bushes with netting and beating the beetles from the bushes into pans containing coal oil can be practised on a small scale. The only remedy which so far has been found at all effective on a large scale "is to spray grape vines and fruit trees with a wash made by adding three or four pecks of freshly slaked lime and a quart of crude carbolic acid to 50 gallons of water." (Dr. C. M. Weed.)

Fig. 50.

The Raspberry Sawfly (*Monophadnus rubi*, Harris), was more than usually abundant in the western counties of the Province, but where promptly sprayed with Paris green and water, and later when the fruit was forming with white hellebore, was easily disposed of.

Scale insects.—The advent of the San José Scale in Ontario had a remarkable awakening effect on the fruit growers of the province, and, as a consequence, there has been during the past season far more enquiry with regard to injurious insects than has ever been the case in a single year before. The vigorous policy of the provincial Government and the excellent conscientious work done by the Inspector, Mr. George E. Fisher, and his assistants, backed up by a rigorous application by the Federal Government of the San Jose Scale Act has undoubtedly had a good effect not only among the thinking fruit growers of the Dominion, but upon statesmen in other countries who have made several enquiries as to what steps were being taken in Canada to stamp out this most injurious insect and prevent further importations from infested countries. Having had ample opportunity of examining the districts which were infested, I can bear testimony to the great success which has attended these efforts. The investigations in connection with the San Jose Scale have brought to light other scale insects where their presence was not suspected ; both the Forbes Scale and the Putnam Scale have been found to be widely distributed, but in very few instances have they occurred in injurious numbers. These two scales are of particular interest owing to their very close superficial resemblance to the San Jose Scale ; the microscopic difference of structure, however, can at once be discovered when the scale insects are taken from their scales and after proper preparation examined under the miscroscope. In addition, both of these species lay eggs at certain times of the year, while the San Jose Scale, it is alleged, never does so. The Forbes Scale (*Aspidiotus Forbesi*, Jnsn.) and the Putnam Scale, (*A. ancylus*, Put.) can be successfully combated by spraying the trees with whale-oil soap, one pound in two gallons of water. The best time to make the application is early in spring before the trees are covered with foliage.

The Scurfy Bark-louse (*Chionaspis furfurus*, Fitch.), Fig. 51., wide-spread, but not very abundant nor injurious has been found in many localities in the western part of the province, and, like the the very injurious Oyster-shell Bark-louse, can be destroyed with

the whale-oil soap solution mentioned above, followed by high culture and good horticultural treatment of the trees.

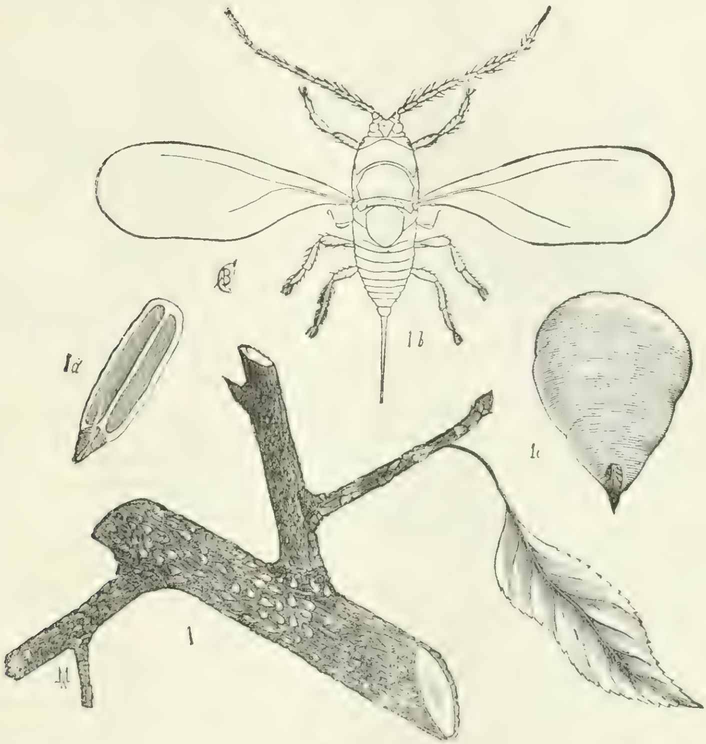


Fig. 51.

NOTES ON INSECTS OF THE YEAR DIVISION NO. I., OTTAWA DISTRICT.

By W. Hague Harrington, Ottawa.

The first insect to attract attention in the spring was the larva of the little Arctian *Phragmatobia rubricosa*, Har., the fuscous little woolly bears of which may be found scurrying over the snow in day time or coiled up in some small depression where they had rested from their wanderings of the day before. On bright days in April, *Aphodius prodromus*, Brahm, filled the air. This species has only been noticed at Ottawa for the last four or five years, but is now as common as *Aphodius inquinatus*, Hbst.

Cutworms.—The Black Armyworm (*Noctua fennica*, Tausch.) was abundant in some localities as near Hull, Quebec, and on the Central Experimental Farm, attacking many plants, but especially clover and peas in fields, and also doing much harm in gardens as a cutworm. This is an early developing species which is full-fed about the end of May, and consequently plays great havoc in beds of young seedlings of early vegetables, sometimes cutting off as many as six or eight peas, or mowing down eight or ten inches along a row of onions or carrots in a night. Occurring with this caterpillar, as cutworms in gardens, were the larvæ of the White Cutworm (*Carneades scandens*, Riley), uncommon at Ottawa, and our commonest cutworm The Red-backed Cutworm (*Carneades ochrogaster*, Gn.). These caused considerable loss in gardens among young vegetables and seedlings of flowers. This latter is also a large species when full-grown ; but as the eggs laid the previous autumn do not hatch till the following spring the caterpillars do not become full-fed till much later in the season than the Black Armyworm and the White cutworm, both of which pass the winter half grown. For some reason the White Cutworm did not revive from hibernation last year till much later than many other cutworms. Poisoning with traps made of bundles of weeds, grass, or clover dipped

in a strong mixture of Paris green and water, or with poisoned bran, were very successful. Cabbages, tomatoes, and other young plants were easily protected at the time of setting out with rings of paper or tin.

THE CODLING MOTH (*Carpocapsa pomonella*, L) was unusually prevalent and injurious in unsprayed orchards. The standard spray for this insect is the poisoned Bordeaux mixture, with which not only the fungous disease "Black Spot of the Apple" is treated, but all foliage-eating insects, as well as the Codling Moth. The formula is copper sulphate 4 lbs., fresh lime 4 lbs., water 40 to 44 gallons, and Paris green 4 ozs.

TENT CATERPILLARS.—The most remarkable occurrence of the season was of the two common species of Tent Caterpillars *Clisiocampa americana*, Harr. (Fig 49) and *C. disstria*, Hbn. (Fig. 52) These two kinds of caterpillars which were about equally abundant, stripped bare many acres of Aspen Poplar, Basswood and Maple groves along both banks of the Ottawa River and along the Canadian Pacific and Canada Atlantic Railways in the counties of Carleton.

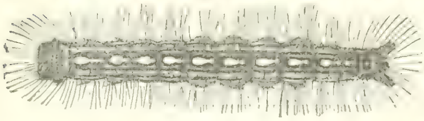


Fig. 52.

THE ASH-GRAY PINION.—Maples were also extensively injured at Aylmer, Que., and at Hull, Que., by the green caterpillars of *Xylina Grotei*, Riley, and *X. antennata*, Walker. These caterpillars are known as Green Fruit Worms, on account of their destructive habit of eating large holes in the sides of young apples and pears. In the Ottawa district they did little harm in orchards, but stripped almost bare large forest trees at the two places mentioned. This is an uncommon attack which has not occurred in anything like the severity of last season since 1885. The ashy-gray moths do not appear until late in the season. There are three species very similar in general appearance. All of these may be taken at sugar in the Ottawa District in September and October.

The caterpillar of the Eye-spotted Bud-moth (*Tmetocera ocellana*, Schif), Fig. 53, was rather common on apple trees in company with the Oblique-banded Leaf-roller (*Cacœcia rosaceana*, Harr), Fig. 54. The Cherry Web worm (*Cacœcia cerasivorana*, Fitch), Fig. 55, was extremely abundant on the wild bird cherries on the Laurentian mountains,

Fig. 53.

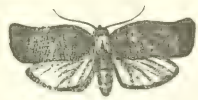


Fig. 54.

Fig. 55.

near Chelsea, Que., the unsightly webs attracting attention along the sides of the mountain road. Although so abundant on the wild cherries, this insect did no harm to cultivated varieties.

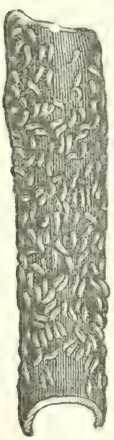


Fig. 56.

THE OYSTER SHELL BARK LOUSE.—(*Mytilaspis pomorum*, Bouche), Fig. 56, is very common and destructive in this district, occurring not only on apple trees but also on many other kinds of shrubs and trees in the garden and forest. It was noted as injuriously abundant on red and black currants, lilac, spiræas, ash, dogwood (*Cornus*), mountain ash and hawthorne. The Forbes scale was found on the fragrant currant (*Ribes aureum*, Pursh), and the Putnam scale on the elm.

The White Cedar Lecanium (*Lecanium Fletcheri*, ckl.) and "Red Spiders did some harm to cedar hedges.

Canker worms were noticeably less abundant than usual, but the Basswood Looper (*Hybernia tiliaria*, Harr), Fig. 57, was very common, the delicate male moths drawing the notice of the least observant by their clumsy flight and the late season at which they appear.

THE CURRANT SAW FLY (*Nematus ribesii*, Scop), was as usual abundant and destructive where the bushes were not treated with the well-known remedies, Paris green or White hellebore.

THE CURRANT APHIS (*Aphis ribis*, L.) was the most destructive insect on currants and gooseberries this season, many bushes being so much injured that they dropped their leaves and the fruit was ruined.

Fig. 57.

THE GRAPEVINE LEAF-HOPPERS (*Erythroneura* species) did much harm to Virginian creepers and grapevines, but particularly to the former. These insects, like the grapevine, flea-beetle (*Haltica chalybea*, Illiger), seem to prefer the Virginian creeper to the grape. This is sometimes very apparent where the creeper and wild grapevine are trained together over arbours.

Two more enemies of the Virginian creeper not often referred to as such, but which both occurred in some numbers this season at Ottawa in the same arbour, were *Saperda puncticollis*, Say, a beautiful longicorn, velvety black with golden yellow stripes down the edges of the wing cases and with spots on the thorax. These emerged from the larger living stems of Virginian creeper, while from younger stems many specimens of *Psenocerus supernotatus*, Say, were reared.

The Mourning Cloak Butterfly (*Vanessa antiopa*, L.) and the Interrogation Butterfly (*Grapta interrogationis*, Fab) were destructive y abundant on elms planted as shade trees. The caterpillars of the former also stripped large branches on willow bushes.

ROOT MAGGOTS in cabbages, radishes, turnips and onions were remarkably destructive right through the season.

Two injurious insects which it was hoped had "run their course" and which for the last year or two had not been nearly so abundant as in previous years, this year again showed up in decidedly increased numbers. These were the imported Larch Saw fly (*Nematus erichsonii*, Hartig) and the Cattle Horn fly (*Hæmatobia serrata* Rob-Desv). For the Horn fly perhaps the most convenient remedy is 1 lb, of pine tar mixed with 10 lbs. lard. A small quantity of this ointment rubbed lightly along the back and sides of cattle once a week during the fly season will have the effect of keeping flies away and will also have a healing and soothing effect upon any sores due to rubbing or licking.

NOTES ON INSECTS OF THE YEAR, DIVISION NO. 2, BAY OF QUINTE DISTRICT.

By J. D. Evans, Trenton, Ont.

Throughout this district the only crop which has suffered to any extent from insect foes during the past season (1898) is the seed pea crop.

For a number of years the cultivation of fancy or seed pease in this section for foreign markets has been very extensive, while a good demand and high prices ruled for such, extra precautions were taken by growers to have the weevil (*Bruchus pisorum*) killed by the seedsmen before they arrived at maturity or had destroyed the pease; but during the past three or four years, when prices have become lower, ordinary grades of pease have been grown to a greater extent than formerly and the grower becoming careless in housing and dilatory in marketing his crop, the weevil has greatly increased in numbers. This occurs not so much along the Lake front of the County of Prince Edward as in inland sections. While many farms may be entirely free from the pest, others will lose from 15 to 30 per cent., while instances occur, although rarely, in which the loss is 40 per cent.

Another destructive agency to the pea crop is a blight said to be caused by a fungous growth which oftentimes will utterly destroy a whole field in a single night. This disease has been very prevalent during the past season and has caused a great loss to the farming community.

NOTES ON INSECTS OF THE YEAR, DIVISION NO. 4, NIAGARA DISTRICT.

By A. H. Kilman, Ridgeway, Ont.

The past season has not been marked by any great insect depredations, at least as far as my personal observation and inquiry have reached, in this locality—Niagara District—but variations in the occurrence of insect pests, pointing either to an increase or a decrease or in the more startling direction of the approach of new foes, is always of interest to students of Entomology and to farmers and fruit growers.

Contary to expectation, the Northern Army-worm, *Leucania unipuncta*, was less in evidence than during 1896 7. In late August, when the imagines of this insect are nearly always to be found, none were observed. The grass-hopper, (*Caloptenus femur-rubrum*) was also conspicuously absent.

Cabbage butter-flies *Pieris rapae*) during the drought in the earlier part of the season, were scarce but late cabbages were much injured by the larvæ of this insect. Similar observations were made in regard to the Colorado potato-beetle. Early potatoes were not materially injured and unwary gardeners, deceived by the non-appearance of the slugs, relaxed their efforts and paid the penalty by seeing the plants of the later crop "sailing under bare poles."

Raspberry canes have been seriously injured in some localities, by a cane borer, probably *Oberea bimaculata*.

An inconspicuous green worm, doubtless the Raspberry Saw Fly (*Selandria rubi*, Harris), operated in spots all over the fruit section, completely destroying some patches of red-raspberries near Niagara Falls.

Neglected vineyards on sandy soil suffered an entire loss of crop from the ravages of the Rose Beetle (*Macrodactylus subspinosus*, Fabr.)

In this locality plums failed to blossom. The Curculio (*Conotrachelus nenuphar*), attacked the later cherries with the result that the fruit was wormy and useless.

Apples, especially in neglected and unthrifty orchards, were scarred by insects and fungi and wormy by larvæ of Codling moth.

The Tussock Moth (*Orgyia leucostigma*) is on the increase here. In the neighboring city of Buffalo, it has become a scourge, defoliating the horse-chestnut trees, and attacking other trees as well. To gather and destroy the cocoons or egg masses in winter seems to be the most feasible method of checking the ravages of this insect.

The birch trees in the parks are attacked by a new pest, an Agrilus. The species will be determined next summer.

Crioceris asparagi, Linn., the Asparagus Beetle, (Fig. 58) which according to Dr. A. S. Packard, is not a native but an introduced species has advanced in its attack upon asparagus plants as far north as Niagara River. Mr. Reinecke informs me that he has found the beetles in abundance on asparagus at Buffalo.

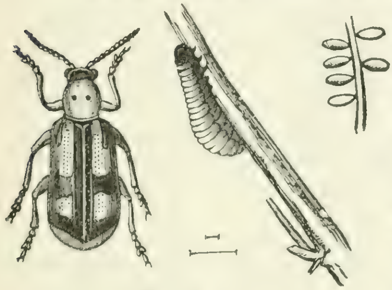


Fig. 58.

The Punctured Clover-leaf Weevil, *Phytonomus punctatus*, Fabr., in August last, appeared in great numbers on the side-walks and fences and on the shores of Lake Erie, but though I have repeatedly examined the clover fields for the purpose of determining the amount of injury done by this particular insect, thus far I have failed to find either the imago or the larvæ on a clover plant.

NOTES ON INSECTS OF THE YEAR.—DIVISION No. 5, LONDON DISTRICT

By R. W. Rennie, London, Ont.

In submitting my report as director for Division No. 5 for 1898, I am very glad to state that there have been no additions to the number of injurious insects in this district, with two exceptions ; in fact there has been a falling off in numbers of older pests that in previous years played great havoc with certain crops.

One exception is the Cottony Maple scale (*Pulvinaria innumerabilis*, Rathvon)—Fig. 59—which appeared in very large numbers this last spring ; in fact, in such large numbers did they appear that on one of the finest streets in this city (London), the trees appeared to have been sprayed with whitewash.

Fig. 59.

In the fifth report of the U. S. Entomological Commission, there is an article copied from Prof. Riley's report as U. S. Entomologist for 1884, page 412, in which he states that the females, before the falling of the leaves, migrate to the branches and twigs, and there fix themselves, generally on the underside. Such has not been the case in this city. They were found occasionally on the branches and twigs, but the vast majority were noticed round the spot where a branch had been cut or broken off ; indeed, so thickly that they almost overlapped each other. They have not confined their attacks to the maple, but have also been working on the grape vine.

It has apparently been quite a study to find out in what manner this spreads. Some think that it is due to planting infested trees, others by birds, insects, water, etc., but if you were to get a colony under the microscope you will soon find out how they spread.

I have a table three feet in diameter on which I use the microscope. One evening I placed a colony on a glass slip under the microscope, which was at one edge of the table, and probably examined them for ten or fifteen minutes, and there left them. Going back again in about twenty minutes, there were none on the slip, but they could be found at the extreme edge of the table. They do not seem to care what they walk over, anything and everything is the same to them. How many reached

the floor I do not know, but from the number left on the table fully two-thirds had got away. Take any insect as small as this is that will walk over three feet in the course of twenty minutes, or less. Surely there can be no doubt as to how they spread, particularly when they do not care what they walk over.

As to the means proposed for destroying this pest, they are various, such as heading in of the branches. (What is the good of this if they do not confine themselves to the branches?) Also spraying with whale oil soap this may be effective, but it is also very expensive. In my own opinion there is nothing better than kerosene emulsion, which I think is one of the best destroyers of insect life that can be used without excessive expense. There are also parasitic enemies, as there are in every other branch of animal life.

Abont the 24th of May last I noticed a small larva feeding on the eggs, but was unable to identify it in this stage Mr. Balkwill, the treasurer of our Society, succeeded in rearing a few, which were identified by Mr. J. Alston Moffat as Hyperapsis signata.

The other exception is *Graptodera chalybea* (Fig. 60), commonly known as the grape vine flea beetle. This insect appeared in great numbers this spring in this locality, although this is not a grape-growing district. This insect passes the winter in a mature state, attacks the buds of the vine as soon as they begin to grow, destroying both fruit and foliage at once. In about three or four weeks the mature insects disappear, but their place is taken by a small, insignificant looking larva, generally black in colour, which very soon makes its presence known by eating holes through the leaf, making the leaves look like sieves; not eating like some larvæ do, starting at one part and continuing until the whole leaf is devoured. They move from place to place on the leaf, apparently selecting parts in the leaf that are most acceptable to the palate of an epicure (as such they undoubtedly are.)

Fig. 60.

These larvæ attain their full growth about the end of July, pupate in the earth, and emerge in from ten days to two weeks in the mature state. The greatest injury is done in the spring by the mature insect.

The most effective remedies for this insect are: To remove all fallen leaves in the fall, and whatever other decaying vegetable matter has accumulated around the vines, and burn it; also in early spring to syringe the vines with a weak mixture of Paris green and water. Hellebore may be used in the summer against the larvæ.

In regard to other destructive insects, as I mentioned in the first part of my report, they have been less numerous than usual.

After remarks had been made by many of those present on the abundance or rarity during the past season of many familiar insects, the following resolution was moved and unanimously adopted:—

"That a most cordial vote of thanks be tendered to the members of the Montreal Branch for the exceedingly generous reception they have given to the Entomological Society of Ontario on the occasion of their annual meeting."

A FEW OF THE MOST TROUBLESOME INSECTS OF THE PAST SEASON (1898).

Read Before the College Officers' Literary and Scientific Society, by H. L. Hutt, B.S.A., Ont. Agricultural College. Guelph, Ont.

As far back as I can remember, I have always taken a great deal of pleasure in studying insect life. On more than one occasion can I remember being punished and disgraced in school, for investigating the jumping capabilities of a grasshopper, or squeezing an involuntary song from a captive cicada. But that was in days gone by. Now the policy of the Educational Department is to encourage the study of such subjects as were then discouraged by hard knocks.

At this institution Entomology has probably always been a part of the regular course. When I began to study it systematically about ten years ago, under the direction of Prof. Panton, it appealed to me at once as one of the most interesting and practical subjects on the curriculum. And the first summer I spent at home after leaving the College, all the available beehives, boxes and glass-topped section cases were converted into breeding cages, where all transformations could be watched in the specimens within. My collection that year was not confined to insects alone, but it contained a variety of creatures from batrachians and lepidopterous larvæ to milksnakes and their eggs. And I might add that one of the most interesting methods of studying this most interesting subject is to watch the transformation and habits of the insects themselves, either in confinement, or as they occur in nature.

As there is no class of society that is exempt from the losses and annoyance caused by insects, a knowledge of their life history and habits is important to all, but to none is it of greater importance than to the farmer and fruit-grower.

During the past summer I received a great many letters enquiring about insects affecting a wide range of crops. To deal fully with all mentioned would necessitate writing a book, but as the subject of this paper I have taken a few of the more common ones that have been the most troublesome, and these, it will be noted, represent fairly well most of the orders into which insects are usually divided.

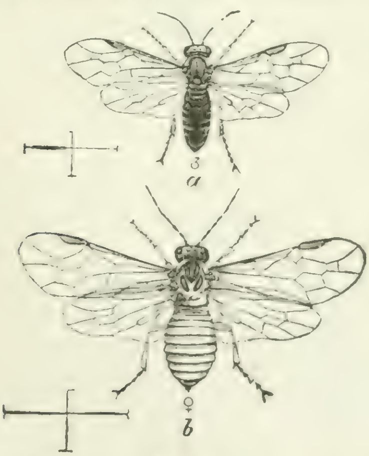


Fig. 61.

Fig. 62.

1. The Currant Saw-Fly, (*Nemátus ribésii*). One of the earliest insects to make its appearance was the Currant Saw-Fly (Fig. 61, *a* the male, *b* the female). This belongs to the Hymenoptera, or membrane winged insects, and is closely related to that most industrious and beneficial of all insects—the honey-bee.

It passes the winter usually in the pupa state, in a slight papery cocoon spun beneath the surface of the ground or under rubbish or leaves. From its winter quar-

ters it emerges early in the spring, about the time of the opening of the buds of the currant and gooseberry. Last spring they appeared in unusual numbers, and during the warm parts of the day might be seen in swarms about the bushes.

In appearance this saw-fly is a little smaller than the common house-fly, and has a yellow body. The male is considerably smaller than the female and is somewhat darker in color. During bright, warm days they are very active, but early in the morning or when the weather is cool and cloudy they are sluggish and may be easily captured.

Saw-flies are so called because of the saw-like ovipositors of the females. Speaking of these, Prof. Comstock says, "This is at least one instance of where the female wielding of a saw is done most skilfully, for the female saw-fly uses these nice tools in a very efficient manner, to make slits in the leaves and stems of plants in which she places her eggs." The eggs are deposited, from 20 to 40 in number, upon the back of the ribs and veins of the leaf, usually upon the lower leaves of the bushes (Fig. 62) They hatch in about ten days and the young larvæ begin to feed at once upon the tender leaves. They grow rapidly, and if unchecked will in a short time entirely strip the bushes of foliage. In the course of about three weeks, the larvæ become full grown (see Fig. 10), when they leave the bushes, spin small papery cocoons, and enter the pupa or resting state. From these the adult saw-flies emerge in a short time, and a second brood of larvæ follow, which strip the bushes again the latter part of summer.

This is probably one of the easiest insects to hold in check, as it feeds upon bushes that are easily got at, and it is readily destroyed by stomach poisons, such as Paris green or hellebore. The most important points in fighting it are to begin early, as the young larvæ are usually well at work by the time the leaves are full grown, and to force the spray up from the under side of the bushes so that it will reach the lower leaves where the caterpillars begin operations.

2. The Larch Saw-Fly (*Nematus Erichsonii*). On the 24th of June last, my attention was directed to the scorched appearance of the foliage on the clump of European larches in the field in front of the College. Upon going to examine them closely, I found that they had been almost entirely stripped of their needles by some kind of insect. Upon further investigation I found one or two small trees on the west side of the clump upon which a few of the larvæ were still at work. It was a smooth, glaucous green worm which I had never seen before, but from certain characteristics, such as the seven pairs of prolegs and the curling under of the last segments of the body, I recognized it at once as the larva of some species of saw-fly. Upon consulting Packard's excellent report on "Forest Insects" I found it fully described as the Larch Saw-fly (*Nematus Erichsonii*), a new and much-dreaded enemy in the larch and tamarack forests.

Like the Currant Saw-fly, it is supposed to have been imported from Europe. The first notice of it on this continent was in 1881 by Dr. Hagen upon specimens found in Massachusetts. Two or three years later it was found in vast numbers in Maine, New Hampshire and other New England States, where it had stripped all the tamarack forests. In the report of the Ontario Entomological Society for 1885, Prof. Fletcher of Ottawa gives an excellent account of its life history, and of the devastation it had made in the tamarack swamps of Quebec and the Maritime Provinces.

It was then noted that the most western point that it had at that time reached was about Casselman, on the Canada Atlantic, about 30 miles east of Ottawa. Its appearance at Guelph last June would indicate that it had made considerable progress westward. In my travels over the Province last summer, I was particular to watch for indications of its presence, and I noticed from the scorched appearance of the tree tops, that it had stripped the tamaracks in many places between here and Walkerton, and that in the large tamarack swamp south of Bradford the trees in July were as bare as if a forest fire had swept through them.

The adult insect is a handsome saw-fly, somewhat resembling the Currant Saw-fly but is a little larger and darker colored, being mostly black with an orange band around the middle of the abdomen. The female deposits her eggs in incisions made in the young

terminal shoots. The young larvæ feed voraciously upon the tender needles and develop with wonderful rapidity. Some idea of their voraciousness, vast numbers, and rapidity of growth may be gained from the fact that the active larval state lasts but a single week, and during this short time they often strip bare vast forests of tamarack.

When mature, they drop to the ground and pass the winter in a dark brown, oval cocoon spun in the moss or grass beneath the trees.

So far as we have learned, there is but a single brood of them during the season, and this is quite enough. As it is, the defoliated trees throw out a second set of needles, and are thus enabled to survive one or two attacks, but when they are stripped of their foliage repeatedly the results cannot be otherwise than fatal. One or two natural enemies have been found preying upon the larvæ, and it is hoped that they may be able to hold them in check, because it is usually impossible to fight them by any of the modern means of insect warfare on account of the inaccessible nature of the places in which they breed. On single trees they may easily be destroyed by spraying, or even by shaking them to the ground, as they cannot crawl back upon the trees again.

3. THE TENT CATERPILLARS (*Clisiocampa americana and C. disstria*). Among the Lepidopterous, or scale-winged insects, none attracted more attention last year than the Tent-Caterpillars. There are two species of these common to this part of the continent, one known as the Apple-Tree Tent-Caterpillar, and the other as the Forest-Tent-Caterpillar. The latter appeared last year in several parts of the province in vast armies. At one place on the W.C. & B. they were reported in the papers as haviug been in such vast numbers that they stopped a train. And judging from the p'ague of them which I saw on St. Joseph's Island, I am quite prepared to believe the reports.

A comparative study of the life histories of the two species is of interest. The adult insect in each case is a reddish brown moth measuring when the wings are expanded from one and a half to one and three-quarters inches across. In this stage they have no power of taking food, and live only long enough to provide for the generation to follow. The eggs are laid about the middle of July in ring-like clusters encircling the small twigs, usually from 200 to 300 eggs in each cluster. The eggs of the *Clisiocampa Americana* may be distinguished from those of the *Clisiocampa disstria* by the oval form of the clusters, those of the latter being squarely cut off at each end. In both cases the egg masses are covered with a thick coat of tough varnish which renders them waterproof, a wise provision of nature, as it is nearly nine months before the young caterpillars emerge from them. During the first warm days of spring they make their appearance, and after taking their first meal from the gummy substance which has protected them for the winter they begin to feed upon the opening buds.

The most striking difference in the two species now becomes apparent in the habits of the young caterpillar. Those of *Clisiocampa Americana* spin a tent in the nearest large fork of the branch upon which they are hatched. Into this they retire at night, during stormy weather, or when they are not feeding, in warm weather they often repose in a black mass upon the outside of it, leaving it regularly once in the forenoon and again in the afternoon to feed. Each caterpillar spins a silken web along the branch wherever it travels. Thus they never lose their way home although they may forage all over the tree The caterpillars of the other species do not dwell in tents and are more disposed to lead a wandering life. When young they often march from place to place in single file close procession. From the time they are half grown until they reach maturity they are wonderfully active and move about as if they were in a great hurry and had no time to lose.

Both species reach maturity in about six weeks, and are then handsome hairy caterpillars, about two inches in length. *Clisiocampa disstria* has a row of white spots down the centre of the back, which distinguishes it from the other species, in which the white line is unbroken.

The Forest Tent-Caterpillar is a general feeder, living on a great variety of forest trees and often doing considerable damage in orchards. The Apple-tree Tent-Caterpillar is not such a general feeder, and is more frequently found on the apple or wild cherry. For the latter it has a particular preference. In our forest plantation where

there are 15 or 20 different species of trees, it was noticed last spring that every tree of the wild cherry had two or three nests of these caterpillars, while not another tree in the plantation was affected.

Another difference between these two insects appears in the construction of their cocoons. Those of *Clisiocampa Americana* are formed of a double web, the outer one loosely woven and filled with a powderly substance resembling sulphur. They are usually hid in some out of the way place, as under rails, boards or rubbish. Those of *Clisiocampa disstria* have none of this powdery substance and are more frequently formed inside of the leaves hanging on the trees. On St. Joseph's Island last summer, I saw hundreds of maples and other forest trees upon which every leaf contained one of these concoons, even the native spruces were so full of them that they appeared as if packed in wool.

4 CANKER-WORMS.—(*Paleacrita vernáta* and *Alsophila pometária.*)—Canker-worms have been very abundant in many parts of the country for a number of years past. There are also two species of these, but they resemble each other so closely that to the causal observer they differ only in name. One is known as the Spring Canker-Worm (*Paleacrita vernáta*) (Fig. 63), and the other as the Fall Canker-Worm (*Alsophila pometária*) (Fig. 64). One of the most noticeable differences in the two species appears in the egg stage. The eggs (Fig. 63 *a* and *b*) of the Spring Canker-Worm are oval in form and are laid in the spring in irregular patches hidden under loose bark or in expanding buds.

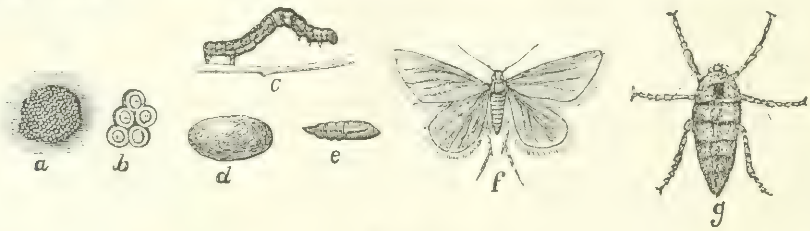


Fig. 63.

Those of the Fall species are shaped like miniature flower pots, are ranged in regular rows in masses (Fig. 65, *a*, *b*, *c*), and deposited in the late autumn in some prominent place on the tree. The larvæ of both species (Fig. 63 *c* and 65 *f*) make their appearance with the opening of the leaves in the spring. They reach their full size in about three weeks and are then about an inch in length. On account of their peculiar method of travelling, by alternately looping and extending their bodies, they are commonly spoken of as "measuring worms." They have another peculiar habit when disturbed of suddenly dropping from the tree and suspending themselves in mid air by a delicate silken web which is spun as they drop. Their appearance in this position is graphically described in the following letter which I received from a correspondent last June :—

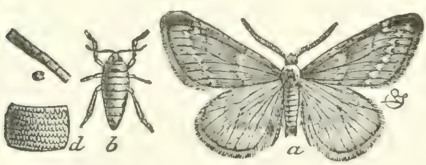


Fig. 64.

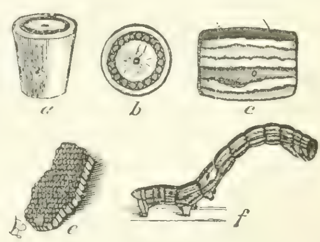


Fig. 65.

BRIGHTON, June 6th, 1898.

DEAR SIR,—Last evening my husband said, "Come with me, I wish to show you a sight." We went into the orchard. "Now," says he, "see that tree over

there, the leaves are all eaten up." "Worms," says I. "Yes," says he, "but not the kind you know." He took a stick and gave a limb a tap, and in an instant one hundred worms were hanging by tiny webs. He then went around hitting all the limbs he could reach, and I think there must have been a million worms suspended in the air beneath that tree. "Now, May," says he, "what am I to do? I have manured and thoroughly worked this orchard for two years, have had it trimmeed, and the worms' nests all taken out of it once this spring, now just look at it." "I'll tell you," says I, "I'll write to the Agricultural College and see what they advise." An answer would be gratefully received, as the orchard is no small item in our accounts.

Yours truly;

——— ———.

In an orchard that is regularly sprayed they can give little or no trouble, as they are easily destroyed by Paris green, but in large shade trees, which are sometimes attacked, and where the spraying cannot easily be done, strategic measures have to be resorted to. From the fact that the female moth in both species is wingless, and after emerging from the pupa in the ground has to climb the tree to deposit her eggs, the placing of a tar band or other barrier upon the trunks of the trees at once suggests itself as a remedy.

5. The Colorado Potato Beetle.—(*Doryphora decem-lineáta.*)—The potato bug, or more properly, the potato beetle (Fig. 13) is with us yet, and he seems to be here to stay. Out of about ten thousand species of Coleoptera common to this country, the potato beetle stands out prominently as the one most generally troublesome. We have become so familiar with it that we seldom think of it but to kill it, yet a few facts as to its history in this country may be of interest. To the late Dr. C V. Riley, of Washington, we are indebted for the best account of it that has anywhere been published, and I have made free use of his little book on "Potato Pests," in the preparation of these notes.

The Colorado Potato Bug, as it has been commonly called, was first described under the scientific name Doryphora decem-lineata, by Thomas Say, in 1824. It was then to be found only in Colorado and the North-Western States, just this side of the Rocky Mountains. Its original food plant was the Sand Bur (Solanum rostratum) a species of wild potato peculiar to that region.

As civilization advanced westward and potatoes began to be grown in its native home, it gradually acquired the habit of feeding upon the cultivated potato, and began its eastward march from potato patch to potato patch. In 1859 it had reached to within 100 miles of Omaha City in Nebraska. In 1861 it invaded Iowa, and gradually during the next three or four years it spread eastward over the whole State. In 1864 and 1865 it crossed the Mississippi into Illinois, at four or five different points coming on in a column about 200 miles broad from north to south. It was then travelling at the rate of fifty miles a year and it was predicted that it would reach the Atlantic Sea board in 1881. On this side of the Mississippi, however, the potato fields were more plentiful and it began to make better time, actually arriving on the Atlantic coast in 1874, seven years ahead of time, its average rate of progress being 88 miles per year. This rate, however, was not uniform, the northern columns of the army made the most rapid progress; the southern columns travelling through a country where potatoes were not so much grown, and under a broiling hot sun, lagged far behind.

The invasion of Ontario began in July of 1870, at two points on the western frontier, namely, near Point Edward and near Windsor. During 1871 they came on in increasing numbers, and it was said that during that summer the Detroit river was literally swarming with them. They were crossing on ships, chips, staves, boards, or any other floating object that presented itself. By June of that year they were common around London, and, Mr. Squirrel informs me, that later that year they had reached as far as Galt. I can well

remember the first one I ever saw; it must have been in the summer of 1872. I was then a little chap attending school on the historic battle field of Lundy's Lane, and I little knew then that I had met an enemy that would refuse to be driven from the country, for their invasion was one not only of conquest but colonization wherever they went.

A few beetles were sent to us last summer which were covered with a very interesting parasite known as *Uropoda Americana*. These are little mites about the size of a small pin-head, and of a flax seed brown colour. Each beetle was so thickly covered with them that hardly any part of its body was visible. The infested beetles were placed upon a potato plant along with some of their healthy relatives in hopes that their enemies might increase and subdue them, but after a few days the infested beetles had disappeared and the parasites with them, while the healthy beetles fed on serenely.

6. GRASSHOPPERS.—The grasshoppers belong to the Orthoptera or straight-winged insects. Of these we have a great many species, but they may all be grouped into two families—the Acridiæ or short-horned grasshoppers, and the Locustidæ or long-horned grasshoppers.

There has been much confusion of terms in the common names applied to these insects. The term locust properly applies to the first family, and not to the Locustidæ, or long-horned grasshoppers. The term locust is also improperly applied to the Cicada, which belongs to another order altogether. To all but entomologists, however, the members of both families are usually known as grasshoppers, and for convenience in this paper we shall use that general term.

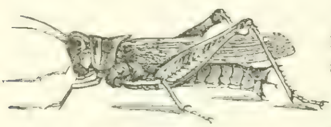


Fig. 66.

The most common species with us is the Melanoplus, femur-rubrum, the red-legged grasshopper, or, more properly speaking, locust.

The females of this species deposit their eggs in holes made in the ground by means of their ovipositors. The eggs are laid in masses in the fall of the year, and hatch during the following spring or early summer. The young do not undergo complete metamorphosis, or change of form, as do the insects of the other orders we have mentioned. There is no larval stage; the young make their appearance as little grasshoppers without wings. They pass through several moults, and the wings gradually develop. With the last moult they become full fledged, and their destructiveness is then increased by their increased powers of locomotion.

Grasshoppers are more or less troublesome every year in all parts of the country, but they are usually particularly plentiful in localities where there is much waste land or poor farming. Two years ago I wheeled through the country from Walkerton to Clarksburg, a distance of about fifty miles There was then in many places through which I passed almost another plague of locusts or grasshoppers. In conversation with a farmer whom I met I learned there were in some sections of that country quite a number of abandoned farms, where grasshoppers had been breeding year after year unmolested. Upon these farms they ate everything bare and then spread to adjoining farms. Good farming with clean cultivation and short rotation of crops is one of the best means of avoiding a grasshopper plague. On the College farm here Mr. Rennie tells me that since the fences have been removed, the permanent pastures broken up, and a short rotation of crops adopted, hardly a grasshopper could be found, whereas the old fence bottoms and permanent pastures were formerly alive with them.

7. APHIDS, OR PLANT-LICE.—Probably the most widely distributed and generally injurious insects during the past two years have been the Aphids, or plant-lice. They are members of the family Aphididæ, belonging to the section Homoptera, in the order Hemiptera. This section or sub-order Homoptera includes not only the Aphids but all of the bark lice, scale insects, mealy bugs, and leaf hoppers, some of the most injurious insects, and at the same time some of the most difficult to fight.

They are characterized, in common with all the other insects of this order, by a suctorial mouth, with which they take all their food in a liquid form, sucking it as juice

from the plants upon which they feed. They are further remarkable for their insignificant size and the wonderful rapidity with which they breed. There are a great many species of plant-lice, and they infest in one form or another a great variety of trees and plants. The tendency has been to name these according to the tree or plant upon which they feed. One of the most destructive species in this and many others sections last year was the *Aphis brassicae*, or cabbage aphis, which affects cabbage, turnips, rape, and other brassicaceous plants. Another was the Aphis mali, or apple aphis. On the cherry there was a very troublesome black species known as Mysus cerasi, or the cherry-tree aphis. These are only a few of them, but they are all alike very troublesome in sucking the sap and reducing the vigor of the plants upon which they feed.

Many species like those on the cherry, apple and plum, excrete a sticky liquid substance known as "honey dew," upon which ants, bees, and flies regale themselves. The presence of ants running up and down the trees is almost a sure indication that aphids are at work upon the leaves. Other species, like those infesting the cabbage and turnip, excrete a white powdery substance which covers their bodies. In the woolly aphis infesting the roots of apple trees, this excretion is so fluffy that the insects appear to be covered with wool.

The life history of plant lice is peculiar. The various species differ considerably in the details of the transformations, but the following may be given as applying to most of them. The eggs which are shiny black are very large for the size of the insect, are laid in the fall upon the food plant. From these hatch in the spring wingless females, which without the intervention of the males soon begin to bring forth living young. In five days or six days these young aphids begin to reproduce in the same way. This process of agamic reproduction and compound multiplication goes on so rapidly that in a short time the progeny of the original "stem mother" mounts up into the millions. If this production of wingless forms continued long, it would mean the starvation of all, by the destruction of the plants upon which they were feeding, but Nature provides for this by the development after a time of winged forms which "hie away to fresh fields and pastures new," and in this way they spread. Often in the fall the air is so full of these flying aphides that a person riding or driving quickly becomes covered them. As the cold weather approaches and vegetation ceases, sexual forms, male and female are developed, the females being wingless. Eggs are again produced to carry the species over to another year.

From the fact that Aphids and other insects of this order insert their beaks and suck their food from the interior of the leaves or stems, it is evident that the application of stomach poisons such as Paris green can be of no avail in destroying them. The material supplied must be something that will kill by coming in contact with their soft bodies. The kerosene emulsion, so generally recommended, has been found to be more or less satisfactory, because of the frequent injury it does to the foliage upon which it is applied. Another remedy much more satisfactory, is a strong decoction of tobacco, made by boiling a pound of tobacco waste in five gallons of water, and this is made doubly effective by dissolving in it a quarter of a pound of whale-oil soap. This should be applied as soon as the aphids appear, as after a time it becomes difficult to reach them because of the curling over them of the leaves upon which they are feeding.

Nature's most active agents in holding plant lice in check are the Lady Birds. Last summer these and their larvæ could be found actively at work devouring the lice upon almost every tree and plant infested.

7. House-Flies.—(*Musca domestica, et al.*) Of all the insects that bother and annoy the house keeper none are more common than the house flies. And notwithstanding this fact the woman, or man either, who can give a full account of the life history of these flies is as rare as the one whose house is free from them during the summer season.

All true flies belong to the order Diptera or two-winged insects. There are several species commonly found in houses, although but one of these should properly be

called the house-fly. This is the Musca domestica, a medium sized grayish fly too well known to need description.

The life history of this species, which is fairly typical of the majority of them, may be briefly outlined as follows: It passes the winter in the house or some other building, hiding in sheltered spots anywhere between the cellar and the garret. A few specimens in the warmed rooms occasionally hum about in the winter, reminding us that they have seen better days. In the early spring the few sole survivors of the swarms of the preceeding year make their appearance. These are mostly females ready at once to become mothers and by the end of the season their children and great great grand children extend to the tenth and twelfth generations. Each female lays on an average about 120 eggs at a time, which are deposited in irregular masses usually in horse manure. The eggs hatch in about twenty-four hours and the larvae coming from them are white footless maggots about half an inch in length. In this stage of its existence the fly is beneficial as a scavenger. In from five to seven days the larvæ attain their full size, and enter the pupa or resting state. In its outward appearance the pupa is a smooth brown oval shell about a quarter of an inch in length and less than half of that in diameter. In manure heaps these may often be gathered by the shovel-full. In some investigations conducted at Washington last summer, as many as 1,200 larvæ and puparia were counted in one pound of horse manure. The pupa stage also lasts only from five to seven days. So that to produce a full fledged fly from the laying of the egg requires only about ten days or two weeks.

To trace the development of the fly through all of these stages is very easy, but to ascertain the length of life of the adult fly is more difficult, and as yet I have seen no data on the subject. The Washington experimenters declared that this was a bit of information almost impossible to obtain correctly, because of the inability of the fly to live in close confinement. Here then is a point in the life history of one of our commonest insects about which we are yet more or less in the dark.

A few of the other species of flies commonly found in houses may be mentioned. The one most closely resembling the house fly in appearance is the *Stomoxys calcitrans*, or stable fly, so troublesome upon horses and cattle. The most important difference in this species is that the mouth parts are formed for piercing the skin. A bite from one of these is just as painful as the sting from a bee, but it has not the same poisonous after-effects.

One of the largest species found in houses is the *Calliphora vomitoria*, or "blue-bottle fly," that big, blue, buzzing, bummy, beggar that goes tearing through the house from room to room as though he owned the premises. He is capable in a few minutes of arousing more fight in a woman than all the other flies combined. A favorite place for this species to lay its eggs, is in meat that has been exposed for a short time. As with most other flies, the time required for development is short, and the rate of increase is so rapid that it has given rise to the saying that a pair of these flies will devour an ox more rapidly than a lion,

One of the smallest species seen in houses, the *Homalomya canicularis*, is sometimes called the small house-fly. This species is largely responsible for the prevalent but erronous idea that little flies become big ones.

In closing this paper we should like to enter a plea for a more general study of this most interesting branch of natural history. In none do we find a greater range for observation and research, and in none can practical investigation be turned to more profitable account.

NOTES OF THE SEASON OF 1898.

BY J. ALSTON MOFFAT, LONDON, ONT.

One of the most noticeable peculiarities of the Entomological year about London, was the scarcity of diurnals; many of the more common forms being to all appearance entirely absent. There were some noticeable exceptions to the rule, *Pieris rapae* for instance. From the early part of May to the end of the month, it was in unusual abundance for the spring brood. More like what one is accustomed to see in the autumn about cab-

bage and turnip fields ; indeed it was more plentiful in the spring than at any other time of the year, something unusual in its history, and starting the inquiry, what had become of its faithful attendant parasite *Pteromalus puparum ?* The yellow swallow-tail *Papilio turnus*, appeared in moderate numbers, also *Limenitis ursula*, whilst that nearly ubiquitous butterfly *Colias philodice* that helps to give life and animation to every rural scene was rarely seen. I am not certain that I saw a Milkweed butterfly, *Danais Archippus* about London until the middle of September. The larger silver-spotted frittillary *Argynnis* were noticeably scarce ; and so on through the entire list of common forms ; which made the meditative contemplation of a landscape dull and uninteresting by reason of their absence.

Collecting at electric light commenced early and continued good up to the end of June, many interesting and attractive specimens being obtainable by that method. The early geometers and some species of the noctuids were in abundance, whilst hybernated specimens of Scopelosoma and Lithophane were plentiful, and many of them were in excellent condition. *L. antennata* must be a very hardy insect, and capable of enduring extremes of cold ; Mr. Bice having found specimens of it about the lights during the months of January, February and March ; the least indication of mildness in the weather was sure to bring it out. July and August were characterized by more their usual unprofitableness to the collector, giving him plenty of hunting but little collecting. There were no reports of any serious injury having been done in this locality to crops or fruits from insect pests. Many of the ornamental bushes and shade trees of the city were rendered unsightly by the presence in great numbers upon their branches of the Cottony Scale, *Pulvinaria innumerabilis*, but the attack passed off without any apparent injury resulting.

On the 2nd of June I received from J. D. B. Mackenzie, Esq , of Chatham, N. B., a letter, stating that he had sent to me for identification, some insects that had appeared upon his cherry trees and literally stripped them of their foliage in two or three days. The insect proved to be *Ademonia rufosanguinea*, Say, of the Chrysomelid family ; an innocent enough looking little beetle that would not be suspected as being capable of working such destruction. It must surely be a rather unusual occurrence ? Their numbers must have been great. He also wished for information as to where he could get a description of its life history ? That I could not give him.

On the 27th of July I received from Clinton, Ont., a box six inches long by four wide and one and a half deep, filled with the remains of Web-worm moths, *Clisiocampa Americana* and *disstria* mostly ; said to have been the result of one night's capture in one street lamp—kind of lamp not stated, electric probably. I had read in the newspapers earlier in the season, accounts of the running of railway trains being interfered with in some localities, by reason of the swarms of caterpillars on the track ; that may have been one of the localities. At all events, that boxful gave evidence of great negligence on the part of those interested, in their dealings with their tent caterpillars.

On July the 22nd, I took a trip to Lake Erie Shore. I had heard a good deal about 'Rondeau,' the Government reserve and the public park there, and that it was easily reached by rail from Chatham, Ont., so I thought it might be a profitable place to spend a day or two. In anticipation I was going to a place well wooded and wild; but instead, I was landed far out upon a sand-bar almost entirely destitute of vegetation. This sand-bar is what separates Rondeau (round water, admirably descriptive) from Lake Erie, whilst the Government reserve is on the opposite side of the bay, nine miles or so away in a straight line and no convenient means of reaching it ; and as my time was limited I made no effort to do so. The sand-bar is being utilized for summer residences with its excellent boating and bathing privileges, and is locally known as 'Erieau,' a euphonious combination but lacking in correct significance. In such conditions there was but little opportunity for me to indulge in my favorite pursuit ; yet even there I came upon two insects which I had never met with alive before. One was that highly ornamented little dragon fly, *Celithemes Eliza*, Hagen, which was quite plentiful amongst the straggling milkweeds and wild rice growing along the bay side of the shore, and was in fine condition as if recently emerged. The abdomen of one sex is ornamented with bright red, the other

with yellow, but their brilliance disappears in drying. In company with it, but in greatly inferior numbers was *Celithemes Eponina*, Drury, which used to be plentiful in one locality at Hamilton. The other find was that attractive Hemipteron *Lygaeus fasciatus*, Fab. Although milk-weeds were to be found for hundreds of yards along the bay shore, there was but one spot where I saw it, and that was a small clump situated between two cottages, and from which by frequent visits I secured seven of them. There I observed on the wing as the first of the season, a few fine fresh specimens of the milk-weed butterfly, *D. Archippus*, Fab.


Fig. 67.

In July, Dr. W. J. Stevenson brought to me a fresh maple tree borer, *Plagionotus Speciosus*, Say, (Fig. 67) the first living specimen of it I have seen taken at London. I could obtain it at Hamilton by the dozen where the shade trees are nearly all hard maple, whilst in London they are as nearly all soft maple; and to that as a cause I have always attributed its absence here.

During the autumn there was the usual appearance in abundance of two or three species of the Cut-worm moths at light, whilst amongst them was to be obtained an occasional rare and desirable specimen of other kinds. About the end of September Mr. Bice secured a number of that attractive Pyralid, *Eudioptis hyalinata*, Linn. It was on the 29th day of September, 1881, that I saw at Hamilton my first specimen of it on the wing, and so far as is known, very few have been taken in Ontario since, and not more than a single specimen in a season. This disclosure of such a marked increase in numbers is of considerable importance to the community, as indicating the possibility of its becoming here, such as it has proved itself to be in the Western and Southern States a first class pest to the cultivators of that delicious fruit, the musk melon. In the Eleventh Report of the New York State Entomologist for the year 1895, after giving an account of the total destruction of some melon patches in the south, which had been cultivated for the market, at page 138 it is stated: "It would appear from the limited literature accesible, that *Eudioptis hyalinata* is more especially a southern insect. I have examples in my collection from Texas. It has also been taken in Michigan, is not uncommon in New Jersey, and has been taken in Canada. I have no knowledge of its occurrence in the State of New York." That it had not been reported from New York State was to me rather a surprise, and I started the question whence came it to us? It would seem as if it must have reached Ontario by way of the west, having found the conditions most favorable for its spreading in that direction. It is the habit in some quarters to speak disparagingly of "mere collectors." But an occurrence of this nature brings forcibly to view the great loss, that even now, our department of science is suffering from the want of more collectors; for it is upon their labors and observations that we are largely depending for our knowledge of the introduction and spread of injurious species. A knowledge of the flora and fauna of any particular district is of great general interest and advantage to all students of nature, whether the individual disclosing it has any time, inclination or ability to devote to the technicalities of the subject or not, and is well deserving of the grateful acknowledgements of all.

Almost the same time as the preceding, Mr. Bice took several specimens of another Pyralid, *Pilocrosis ramentalis*, Led. This species was represented in the Society's collection by a single specimen taken by me at Hamilton, and named for me by Mr. Grote, then of Buffalo, who had much of interest to tell me of the peculiarities of this insect, one noticeable thing about it is the long scales covering the costal margin at base of the front wings of the females, which can be raised so as to disclose the membrane. Mr. J. Johnston of Hamilton informed me that these two species are represented in his collection by a single specimen of each, taken by him there many years ago. Recently I have seen a specimen of *E. hyalinata* amongst some material sent to me for determination by Mr. C. E. Grant, of Orillia. In September the Tomato Sphinx, *S. quinquemaculata*, Hub, was quite plentiful, which suggests some interesting queries concerning the life history of this species. It is considered to be single brooded in this latitude; but it is known to mature occasionally in confinement the same season as produced. Were these

September specimens from eggs of an early brood, or were they from belated chrysalids of the previous summer's production? It has been observed that there is a great difference in the time of their appearance in nature, some showing themselves in early June, whilst fresh specimens may be obtained at the end of July; the location of the winter quarters of the pupæ influencing the time of maturing to some extent most likely. Again, if these late comers produced ova could they pass the winter safely? If not, then it would help materially to reduce the numbers for the following season. Of Sphingidae less frequently met with in this locality, Mr. Bice took specimens of *Ampelophaga versicolor* Harr. The Tobacco Sphinx, *S. Carolina*, Linn., and *S. Cingulata*, Fab., or *Convolvuli* of Linn. One thing secured by him, and determined by Dr. J. B. Smith, which is new to the Society's collection, is a single specimen of *Hydroecia limpida*, Guen., whilst several other Noctuids of the season's capture are not yet identified.

THE FREEZING OF INSECTS.

By Henry H. Lyman, Montreal.

In the 22nd Report of the Entomological Society of Ontario, being that for 1891, there appeared a paper from my pen under the title, "Can Insects Survive Freezing?"

I have recently come across further records of observations upon this subject, and deem them of sufficient interest to be republished.

In looking over an interesting book of travels, entitled "A journey from Prince of Wales's Fort in Hudson's Bay to the Northern Ocean, undertaken by order of the Hudson's Bay Company for the discovery of copper mines, a North West passage, etc., in the years 1769, 1770, 1771, and 1772, by Samuel Hearne," published in 1796, I came across the following interesting notes on page 397. :—

"Frogs, Grubs, and other Insects."

"Frogs of various colours are numerous in those parts as far north as the latitude 61°. They always frequent the margins of lakes, ponds, rivers, and swamps; and as the winter approaches they burrow under the moss at a considerable distance from the water, wher they remain in a frozen state till the spring. I have frequently seen them dug up with the moss (when pitching tents in winter) frozen as hard as ice; in which state the legs are as easily broken off as a pipe stem, without giving the least sensation to the animal; but by wrapping them up in warm skins, and exposing them to a slow fire, they soon recover life, and the mutilated animal gains its usual activity; but if they are permitted to freeze again they are past all recovery, and are never more known to come to life. The same may be said of the various species of Spiders, and all the Grub kind, which are very numerous in those parts. I have seen thousands of them dug up with the moss, when we were pitching our tents in the winter; all of which were invariably enclosed in a thick web, which Nature teaches them to spin on these occasions; yet they were apparently all frozen as hard as ice. The spiders, if let fall from any height on a hard substance, would rebound like a grey pea; and all the Grub kind are so hard frozen as to be as easily broken as a piece of ice of the same size; yet when exposed to a slow heat, even in the depth of winter, they will soon come to life, and in a short time recover their usual motions."

In Dr. H. Guard Knaggs' Lepidopterist's Guide, on page 44 of the 1871 edition, under the heading of "Ailments of Larvæ," I find the following :—

"Frost Bite.—It is well known that larvæ, which have been so stiffly frozen that they might have been easily broken, have afterwards recovered. The chief thing to be remembered in the treatment of such cases, is that the thawing should be effected very gradually, rapid thawing being dangerous."

ODOUR OF THE SAN JOSE SCALE, *Aspidiotus perniciosus*

By F. M. Webster, Wooster, Ohio.

In the many accounts of this insect I do not recall that attention has been called to the odour that is associated with this insect and which in cases of excessive abundance, can be detected at a considerably distance away. Where the air is quiet it is often possible to detect the presence of a badly infested tree a yard away, and I presume that with more acute olfactories, such as insects are supposed by many to possess, even the presence of a more limited number of the scale might be detected at a much greater distance. As ants do not appear to be at all partial to this Coccid, at least in this country, it is not easy to understand what influence this odour can have in the economy of the species. It is possible that, in its native home, this odour might attract other insects and thus afford a means of diffusion, not at present so available to the scale in this country.

The Odour of Coccidæ.—Prof. Webster's interesting note leads me to offer a few remarks. The species of the subgenus of *Toumeyella* of *Lecanium* have quite a strong musky odour; but ordinarily I have been unable to detect any marked odour in species of Coccidæ. I suppose, however, that all possess some odour, and that its purpose is to attract the males to the females. This seems the more probable when we remember that in many species the male puparia are not on the same part of the plant as the females. Here at Mesilla Park, also, I have lately seen a male of *Margarodes hiemalis*, Ckll. ined, run over the ground until it detected a spot where a female was buried, and then dig down to the female. It must certainly have detected its mate by the sense of smell

T. D. A. Cockerell.

LIFE HISTORY OF THE SHEEP SCAB-MITE, *Psoroptes communis.*

By C. P. Gillette, Fort Collins, Colorado.

I am not aware that the full life-history of this insect has been published, though I shall not be surprised to learn that such is the case.

In order to know how long a time should intervene between the first and second dippings for the cure of scab, we must know the period of incubation and also the entire time elapsing from the deposition of the egg up to the time that the mite from that egg, if a female, may be itself depositing eggs. These points were determined in a series of experiments conducted by the writer one year ago and were reported in a local paper, the "Fort Collins Courier," last spring. I took seventy-five eggs from a lock of wool drawn from the back of a badly infested lamb and, after dividing them in two nearly equal lots, placed them at once on the skin of the backs of two lambs that were not infested with the mites at the time. In order to irritate the surface a little and better prepare it for the little mites that would begin at once to hatch, a lock of wool was drawn in each case from the particular spot where the eggs were placed.

Mr. Ball, assistant in my department, made a special examination of these "cultures" once a day until the mites from the eggs were fully grown and themselves laying eggs.

At the first examination a few young mites were found, which was to be expected as a few eggs among so many would be about ready to hatch. At the end of the fourth day all the eggs had hatched. At the end of the ninth day a few individuals were found in copula, and on the eleventh day eggs were found. As it required four days for the newly deposited eggs to hatch, the entire time elapsing from egg to egg would be fourteen or fifteen days.

As there would be eggs in all stages of incubation upon a sheep when the latter is dipped for the cure of scab, I have set the limit of time for the second dipping at not sooner than five days and not later than ten days after the first dipping. If the second dipping comes at a time outside this limit, there will probably be eggs upon the sheep again.

OBITUARY.

Professor J. Hoyes Panton, M.A., F.G.S.

It is our sad duty to record the death of Professor Panton, which took place at Guelph, on the 3rd of February, 1898, after a long and very painful illness, which he bore with the utmost patience and resignation. He was born at Cupar, in Fifeshire, Scotland, and was brought out to Canada when a child ; his father settled in Toronto at first, and removed, after some years, to Oshawa. He was educated at the Whitby High School and Toronto University, where he graduated with honors in Natural Science in 1877. The following year he was appointed Professor of Chemistry in the Ontario Agricultural College, but after a few years resigned the position and removed to Winnipeg, where he became principal of the Collegiate Institute. In 1885 he accepted the invitation of the Ontario Government and returned to Guelph, where he filled the position of Professor of Natural History and Geology in the Agricultural College till the time of his death. His work there had special relation to economic entomology and botany, on which subjects he issued many useful bulletins to farmers and fruit growers. He also published two small works on Economic Geology and "Insect Foes," which are valuable manuals of an elementary character. In 1896 Professor Panton attended for the first time the annual meeting of the Entomological Society of Ontario, though he had long been a member, and on that occasion read very interesting and useful papers on "Entomology for Rural Schools" and "Two Insect Pests of 1896—the Army Worm and the Tussock Moth." At the annual meeting in October, 1897, he was elected vice-president of the Society, but was unable to attend owing to the illness which had already seized upon him. The following resolution of condolence was adopted at a meeting of the Council held in March : "The members of the Council of the Entomological Society of Ontario have heard with profound regret of the death of their highly respected colleague and vice-president, J. Hoyes Panton, M.A., F.G.S., Professor of Biology and Geology in the Ontario Agricultural College, Guelph They desire to place on record their admiration for his talents and attainments in natural science, and their deep sense of the loss which economic entomology in this Province sustained by his removal in the maturity of his powers and at an age when he was capable of performing much useful work. They beg to offer to Mrs. Panton and family their respectful sympathy in the great bereavement which has befallen them."

On the 18th of February, 1898, Mr. Johnson Pettit died at Buffalo, N.Y., and was buried a few days later at Grimsby, Ont. For many years Mr. Pettit was a most diligent and successful collector of Coleoptera in the neighborhood of Grimsby, and was well known amongst entomologists both in this country and the United States. After forming a very complete collection of the beetles of Ontario so far as known at that time, he gave up the pursuit and turned his attention to geology. Subsequently he sold his cabinet of insects to the Entomological Society of Ontario at a nominal price, in order that it might be kept in a place of safety and preserved from destruction. His work was characterized by remarkable neatness and painstaking accuracy.

Professor David Simons Kellicott was born at Hastings Centre, Oswego County, N.Y., January 28, 1842, and died at his home in Columbus, Ohio, April 13, 1898. In his boyhood his frail constitution and delicate health required him to spend much of his time out of doors, and it is to this, no doubt, that in part at least his love for nature may be traced. He graduated from Syracuse University with the degree of B. Sc., while the institution was yet known as Genesee College, teaching one year in Southern Ohio prior to his graduation. After graduating, he taught one year in Kingston Normal School, Pennsylvania, after which he was connected for seventeen years with the State University, at Buffalo, N.Y., being Dean of the College of Pharmacy, and also Professor of Botany and Microscopy. He came to the Ohio State University in 1888, where, for ten years, he has occupied the chair of zoology and entomology. At the time of his death he

was General Secretary of the American Association for the Advancement of Science, President of the American Microscopical Society, and Treasurer of the Ohio Academy of Science. He had served as President of the Buffalo, N.Y., Academy of Science, and the Ohio Academy of Science.

Animal parasites of fishes, and the rotifera, from time to time claimed a considerable portion of Professor Kellicott's attention, but his entomological work won for him the admiration of the entomologists of America. Patient, conscientious and utterly devoid of selfishness, he was one of the mest kind and loveable men the writer has ever met. Faithful and just with his colleagues and the idol of his pupils, seeking patiently and industriously after the truth, he won esteem while living, and in his death he has left numberless friends to mourn his loss. If there was ever a man who deserved the reward: "Well done, thou good and faithful servant," that man was David S. Kellicott; and the fruits of his labors will stand as an enduring monument to his faithfulness among his fellow men. He began to contribute to the Canadian Entomologist in 1878, his last article appearing in 1896. F. M. WEBSTER.

DR. JOSEPH ALBERT LINTNER.

By the death of Dr. J. A. Lintner, which occurred at Florence, Italy, on May 6th economic entomology has lost one of its oldest, ablest, and most distinguished devotees. He was of German parentage, and was born at Schoharie, N.Y., February 8, 1822. He graduated from the Schoharie Academy at the age of fifteen, and for the next thirty years was actively engaged in mercantile pursuits in New York City, Schoharie and Utica. The study of natural history became a fascination for him early in life, and in 1853, he turned his attention especially to insects and rendered valuable aid to Dr. Fitch, who was then making an entomological survey of the State of New York.

Dr. Lintner's first paper upon insects wes published in 1862, and six years later he became zoological assistant in the New York State Museum of Natural History. He continued in the service of the State until his death, working as assistant in the Museum for twelve years, and in 1880 receiving the appointment of State Entomologist. This thirty years of continuous, active service in an official capacity, in a useful and limited scientific field, and in a single State, is certainly a remarkable record, and one which speaks volumes of praise for Dr. Lintner.

He richly deserved the honour of the degree of Ph. D. conferred upon him in 1884 by the University of the State of New York. He was also honoured with the presidency of several scientific associations, and his name is enrolled among the members of many entomological and other scientific societies, both in America and in Europe. The publications of Dr. Lintner merit the highest praise and deservedly entitle him to the foremost rank among the economic entomologists of the world. He published more than a thousand miscellaneous articles upon injurious insects, besides his four important "Entomological Contributions" and his twelve reports as State Entomologist; probably the thirteenth report, for 1897, is in the printer's hands.

These reports are justly entitled to the highest rank among the scientific publications of the great Empire State. They represent the highest ideal or model of what such reports should be, both from a scientific and a practical standpoint. For typographical neatness and scientific accuracy, for the simple, yet elegant and dignified, way in which dry, scientific facts are made interesting and adapted to the understanding of the agriculturist, Dr. Lintner's reports have not been excelled in the world's entomological literature; such indexes as his reports contain are rare in any literature. One is still more impressed with the scientific and literary attainments of Dr. Lintner, when one understands that, practically, he never had any of the modern facilities, such as are found at many of our experiment stations, for studying the habits of insects; his office was his literary sanctum, laboratory, museum, library and insectary combined.

Dr. Lintner was a man of quiet and dignified manners, always courteous and pleasant to meet in social intercourse. He was ever ready to impart from his vast fund

of knowledge; and being an expressive speaker, he always commanded the attention of scientific bodies which he was called upon to address. His frequent addresses before horticultural and agricultural societies in his own and in other States, and farmer's meetings of all kinds, were always full of information.

He had recently been granted a well-earned six month's leave of absence, and was spending it in sunny Italy when the death summons came. In Dr. Lintner the agriculturists of New York found one of their best and most helpful friends, and entomologists the world over, a true and sympathetic co-worker. His name well deserves a place in that list of names enshrined in the hearts of every American economic entomologist—Harris, Fitch, Walsh, Le Baron, Riley—and Lintner.

M. V. Slingerland.

BOOK NOTICES.

Twenty-first Report of Observations on Injurious Insects and Common Farm Pests during the year 1897, with Methods of Prevention and Remedy. By Eleanor A. Ormerod, London: Simpkin, Marshall, Hamilton, Kent & Co., 1898 (1s. 6d., pp. 160.)

We beg to offer our hearty congratulations to Miss Ormerod on the publication of the twenty first of her Annual Reports. Twenty-one years is a long period for anyone to carry on a laborious work, but this talented and indefatigable lady has not only accomplished a most valuable and important work, she has done so without any assistance except that of her late lamented sister, and entirely at her own expense. On this side of the Atlantic, Reports of this character are published by the Government of the Province or State to which they belong, but in England no official recognition has been shown, and though the country has undoubtedly been saved hundreds of thousands of pounds by the instructions given in these Reports to the farmers and gardeners of Great Britain, whereby they have been able to intelligently cope with their insect foes and employ the best methods of prevention of their attacks, yet no aid has been afforded her from the public purse—no recognition of the immense value of her work has been vouchsafed by the powers that be. But while officially ignored, Miss Ormerod's name and work are held in the highest honour throughout Great Britain and treated by the press in every department with the utmost respect; and in many British colonies and several foreign countries her name is widely known and her talents fully recognized.

A single observer, however able and industrious, could not possibly pay attention to all the manifestations of insect injury throughout the British Isles, but Miss Ormerod has by degrees gathered together a corps of observers in every county and district throughout the United Kingdom; and is kept closely informed of all that causes injury or loss to crops or fruit, and to live stock as well. During the past year she received about 3,000 letters on Entomological subjects, and with the aid of a secretary was enabled to attend to them all. She thus conducts at her own charges what ought to be a Division of Entomology in the Department of Agriculture at London.

In the Report before us thirty-six species of insects are dealt with and figured, their ravages described, and methods of prevention and remedy fully given. Several of them are familiar to us on this side of the Atlantic, e. g. Apple Codlin Moth, Cockroaches, *Xyleborus Xylographus*, Mediterranean Flour-Moth (*Ephestia Kuhniella*), etc.

From the care and accuracy which characterize her descriptions and figures, Miss Ormerod's work is of permanent value to economic Entomologists everywhere, and her reports are always received with welcome and gratitude by those who have the good fortune to obtain them. That she may long be spared to carry on her admirable work is the earnest aspiration of her many friends.

C. J. S. B.

Out Door Studies: a Reading Book of Nature Study, by James G. Needham; 1 vol. pp. 90. New York, Cincinnati, Chicago: American Book Company.

These are a series of stories of animal life, written in a charmingly interesting way, and designed to lead on a youthful reader to observe for himself the wonders of nature that are everywhere open to his view. It begins with an account of the common wild Snap-Dragon or "butter and eggs," and tells how the peculiar structure of the flower is designed for the visits of the bumble-bees who come for the nectar and carry off the pollen as well. The next chapters are on Chipmunks; Galls and their makers; the Golden-rod and its visitors and tenants; Crows and their Doings; Dragon-Flies which, as our readers may remember, have been special objects of the author's studies; Eye-spots on insects which aid in the protection of their owners; and Ant-lions. Any boy or girl, who takes up the book and dives a little way into its pages, will surely read on with delight and when the little volume is closed, be anxious to sally forth and see if he (or she) cannot find some similar marvels of nature and learn their meaning, while admiring their beauty.

The book is one of a series designed for the use of school-children who are about to enter the High Schools. It is beautifully illustrated with about ninety wood-cuts, the work of Mrs. Needham, the author's wife, and is provided with an index, and a list of the scientific names of the animals and plants referred to in the text.

C. J. S. B.

The Pterophoridæ of North America, by C H. Fernald, A.M., Ph.D., Revised Edition. July 30th, 1898. Boston: Wright & Potter Printing Co., 18 Post Office Square, 1 vol, 8vo, 84 pp., 9 plates.

Any one who has a copy of Professor Fernald's manual of the Crambidæ of North America will hardly need to be told that this later work is exactly what every student or collector of the Micro-Lepidoptera wants, and that the way is now made easy for him when he wishes to identify his Plume-moths and learn all that is thus far known about the North American species. It is characterized by its author's well-known accuracy and conciseness of statement, and is a complete monograph of the family as far as this continent is concerned. It begins with an historical account of the family in the writings of European Entomologists and the more recent publications in America. This is followed by short chapters on the structure, habits, early stages and systematic position of the Plume-moths. The body of the work is taken up with descriptions of the genera and species, including very useful synopses in each case. Three of the plates illustrate the external anatomy and the structure of the wings, the remainder depict the genitalia of the species. We miss, however, the exquisite coloured plates that so beautifully illustrated the Crambidæ. We need not say more than that this is a full and entirely satisfactory work on the Pterophoridæ and that it maintains the high standard of excellence that we now expect in the author's scientific productions.

C. J. S. B.

Agriculture, by C. C. James, 200 pp., George N. Morang, publisher, Toronto, 1898.

It has been the lot of few authors to accomplish satisfactorily what in their preface they state to have been their object as Prof. James has in preparing the 200 page Manual of Agriculture which has lately been given to the farmers of Canada. The author has had special opportunities, which he has made the most of, of learning not only what was needed by the intelligent farmers of the Dominion, but what was the best way of presenting this information to them. Both as Professor of Chemistry at the Ontario Agricultural College and as Deputy Minister of Agriculture, Prof. James has been brought into close contact with the leading and rising farmers of Ontario. The new Manual will fill a decided want, which is none the less from the fact that this want may not have been noticed by some until their attention was drawn to it by seeing how well it has been filled.

The purpose of the book is "to aid the reader in acquiring a knowledge of the *science* of agriculture, as distinct from the *art* of agriculture, that is, a knowledge of the 'why,' rather than a knowledge of the 'how.' The science of agriculture may be said to consist of a mingling of chemistry, geology, botany, entomology, physiology, bacteriology, and other sciences, in as far as they have a bearing upon agriculture. The aim has been to include but the first principles of these various sciences and to show their application to the art of agriculture. . . . An intelligent understanding of the science underlying the art of agriculture will add much interest to what is otherwise hard work, and as a natural consequence, the pleasure of such work may be greatly increased."

Every day the fact is being recognized more and more that the elements of those sciences which underlie all progress in every branch of agriculture *must* be taught in the Public and High Schools of the country. Already simple nature studies and the first steps in chemistry and geology are taught in the schools of Manitoba and Ontario, and these studies have proved to be not only of use and attractive to the students, but a ready means of creating a bond of sympathy between the teacher and his pupils; more especially has this been the case with those energetic and restless souls too often now called "bad boys" more, perhaps, from lack of understanding or skill in management on the part of the teacher than from a superabundance of real badness on the part of the taught. Boys play truant because they find more to interest them outside the school than at their desks. If therefore the things which appertain to out-of-doors can be brought inside the schoolroom without robbing them of too much of their outside flavor, they will be a sure bait to catch the attention of all bright healthy boys and girls. Their study will arouse interest at once and the habits of concentration, power to observe and compare, and the necessary development of the faculties of exact thought and accurate description will be available for all other branches of study with which the pupil is engaged.

This book may be used as a text-book in High Schools and Public Schools. It would be well indeed for Canada if its use were made compulsory in every school in the land. The great truths laid before the reader are presented in a simple straightforward manner intelligible to all. The subjects are so skilfully arranged and concisely stated that a surprising amount of accurate information is given in this small octavo of 200 pages. The value of this simple knowledge to practical men is not, I believe, overstated when I aver that if all the farmers in Canada would read this little work, as they most certainly should, its appearance would mark an epoch in the history of the Dominion, which would be made manifest to all by an enormous increase in the crops and wealth of the whole country.

The scope of work is shown by the following brief epitome of subjects: Part I. treats of the Plant, its development, structure, food and functions; Part II., Soil, its nature and treatment; Part III., Crops of the Field; Part IV., The Garden, Orchard and Vineyard; Part V., Live Stock and Dairying; Part VI., Bees, Birds, Forests, Roads and the Home.

In these different sections the insect and fungous enemies of crops are treated at some length. This little volume is bound in cloth and well got up; although some of the illustrations are rather roughly executed, it is on the whole most excellent and for the price, 25 cents is a marvel of cheapness.—J. F.

THE WINTER FOOD OF THE CHICKADEE, Bulletin 54, New Hampshire College of Agriculture, by Clarence M. Weed—There is something particularly charming about those confiding little feathered denizens of the woods which brave our cold northern winters and stay to cheer us at a time of the year when there is so little animated life. The Chickadee or Black capped Tit-mouse *(Parus atricapillus)* is at once one of the most cheerful as well as one of the most useful of our common native winter birds. What a bright, busy, happy sight is presented by a flock of these little friends; for they are all friends these little balls of black satin and grey down, they are far too busy and well employed to waste time in fighting. Satan has a hard time of it in "some mischief finding" for these little fellows to do, for their hands are never idle, as they hurry

through the woods, running up or around the trunks of trees or hanging head downwards from a slender twig, never still for more than an instant, as they peer into every tuft of moss, every crack or cranny in the bark, along the twigs, under the bud scales of deciduous trees or among the leaves of evergreens, talking cheerfully to themselves and each other all the time as they carry out their useful mission in clearing the trees and shrubs of countless insect enemies ; woe to the luckless caterpillar, chrysalis, spider, or beetle which comes within the range of their sharp black eyes. Nothing comes amiss to these insatiable hunters, from the minute, shining black eggs of an aphis to the fat chrysalis of a Cecropia Emperor Moth ; with deft blows the hard sharp beak soon penetrates the thick silken cocoon and in a very short time the marauder is away looking for another victim. Dr. Clarence Weed publishes in this interesting bulletin the results of some careful investigations which he has carried out as to the winter food of the chickadee. He shows that more than one half of the food of this bird during the winter months consists of insects, a large portion being in the form of eggs. Vegetation of various sorts made up a little less than a quarter of the food, and two-thirds of this quarter consisted of the buds or bud scales which were believed to have been accidentally eaten along with the eggs of plant-lice. These eggs made up more than one-fifth of the entire food and formed the most remarkable element of the bill of fare. This destruction of myriads of eggs of the plant-lice which infest fruit, shade and forest trees is probably the most important service which the chickadee renders during his winter residence. More than 450 of these eggs are sometimes eaten by one bird in a single day as well as the eggs of many other kinds of our most important insect enemies of the forest, garden and orchard. Dr. Weed figures in his bulletin some twigs of various trees upon which the eggs of insects have been deposited. Among these are represented the egg masses of the tent caterpillars and the Fall Canker-worm, both of which are favourite foods of these useful little birds. In addition to eggs or insects, many caterpillars and other stages in the development of insects are destroyed. One interesting figure shows the winter cases of a small caterpillar, closely hidden behind apple buds ; these are, in all probability, those of the Eye-spotted Bud-moth, sometimes one of the most troublesome and destructive enemies of the fruit-grower. This bulletin shows much careful work in a field which has been, to a large extent, neglected by entomologists, and Dr. Weed should receive the thanks of all lovers of birds for the proofs which he furnishes of the real benefits we receive from these little favorites. It was pleasing for some people to know and most people to think that these birds were useful, but it is now possible to prove it to all who are willing to learn.—J. F.

Scudder's Revision of the Melanopli.

One of the most important works on Entomology which has been issued by an American author in recent years is that entitled a "Revision of the Orthopteran Group Melanopli (Acridiidæ) with Special Reference to North American Forms" by Samuel Hubbard Scudder.* It is more important because it deals with a representative North American group of insects whose members, between April and November, leap from our pathway in profusion whether we stroll through open woodland, sunny meadow, or along the roadside, and yet of whose classification and nomenclature the greatest confusion has heretofore existed. It was only another example showing the truth of the old saying : "that the common things around us are those of which we are most densely ignorant."

True, of one of the members of the group, the "Rocky Mountain Locust," *Melanoplus spretus* (Thos.), more has, perhaps, been written than of any other insect on earth, yet it is but one of 207 of its kind which are described at length by Mr. Scudder. The others are scattered far and wide over the continent of North America and the descriptions of the ninety-two species hitherto rightfully known to science were distributed through an almost equal range of literature. No better evidence of the need of the "Revision" is necessary than to know that after a careful examination of nearly 8,000 specimens, 7,000

*Proc. U.S. Nat. Mus., XX., 1897, No. 1124, pp. 1-421. Plates I.-XXVI.

of which belonged to the single genus Melanoplus, the author has in it reduced forty-seven supposed species to synonyms and has established eighteen new genera and described for the first time 115 species.

With a group whose members are so closely kin as those of the Melanopli it has heretofore been almost an impossibility for the specialist—let alone the tyro—to satisfy his conscience as to the status of a specimen which he might have in hand. The available literature was so scattered and the different authors had seized upon so many different characters as representing what appeared to them the most striking structural features, that the whole mess was worse than a Chinese puzzle. By seizing upon the variations of the abdominal appendages of the male as the most salient features showing specific rank, and by publishing actual drawings of two different views of the male abdomen of each of the 207 species, Mr. Scudder has done much to render possible the ready identification of each species—a task which otherwise would have been very difficult, owing to the size of the group and the close similarity of many of its members. Analytical keys to genera, and to species where the genus is not monotypic are also given, and add much to the value of the work; as does also the full list of localities from which each species has heretofore been taken.

Taking into consideration its size and importance, the defects of the "Revision" are very few. The one thing which the tyro will find most lacking is a glossary of the technical terms. In a work of the kind these are necessarily numerous, and though they may be plain to the author and to specialists, to the beginner they are often extremely confusing. Even a figure of a typical locust with all the parts named would have been a great aid. A tendency to multiply species can here and there be noted, as on p. 138, where *M. bivitattus* is separated from *M. femoratus* only by the color of the hind tibiae, which is an exceedingly variable character.

More might have been added along ecological lines, but this is a work for the future which the student of the group can now take up with renewed energy. For before one can write of a species he must have a name to handle it by; something which in the case of many of the members of this group has heretofore been lacking. Now, by using a little care and accustoming himself to the technical terms, the student can, by the aid of the "Revision," soon bring order out of chaos and label his Melanopli with correctness and despatch. In conclusien, it may be said that any one who will use the work will soon conclude that the aim of the author, "to enlarge and systematize our knowledge of this important group as a basis for future studies," has been well and successfully accomplished.

W. S. B.

A Text-Book of Entomology, including the Anatomy, Physiology, Embryology and Metamorphoses of Insects, for use in agricultural and technical schools and colleges, as well as by the working entomologist. By Alpheus S. Packard, M.D., Ph.D. New York: The Macmillan Company, 66 Fifth avenue. 1898. (Price $4.50.)

The book is primarily divided into three parts. Part I. being devoted to morphology and physiology, Part II. to embryology, and Part III. to metamorphoses. Under these divisions Dr. Packard treats his subject as follows: Position of insects in the animal kingdom. Relation of insects to other arthropoda. Insects (hexapoda). The head and its appendages. The thorax and its appendages. The abdomen and its appendages. The armature of insects. The colors of insects. Muscular system, Nervous system. Sensory organs. Digestive canal and its appendages. Glandular and excretory appendages of the digestive canal. Defensive or repugnatorial scent glands. Alluring or scent glands. Organs of circulation. Blood tissue. Respiratory organs. Organs of reproduction. Development of the egg, larva, pupa and imago. Hypermetamorphism. Summary of the facts and suggestions as to the causes of metamorphism.

The volume contains 729 pages, including a carefully prepared index, 654 figures and numerous valuable bibliographical lists. We certainly have nothing in the way of entomological literature, in this country, that will cover the field of development of insects as will this last work of Dr. Packard. Not only the teacher and student, but the educated men and women of the world at large who may desire to know more of the anatomy,

physiology and metamorphoses of insects, will find in this work the very aid that is most desired. With this work and some other like Comstock's Manual, any student of ordinary ability can begin at the very foundation of entomology and work his way upward, fully as easily as has heretofore been possible in zoology. The advent of this work certainly marks the trend of entomological studies in America. In future, except in some particular groups, we are to have less species-making and more studies of the development and transformations of those already well known in the adult stage, as well as of their inter-relations with each other and with other organisms about them. We shall not study dried corpses, alone, but life in connection therewith, and the possession of pinned specimens of the adults in our cabinets will only increase our desire to know more of the problems of their existence F. M. W.

HANDBOOK OF INSECTS INJURIOUS TO ORCHARD AND BUSH FRUIT. By Eleanor A. Ormerod. London: Simpkin, Marshall & Co., Sept., 1898. 8 vo., 286 pp.

The excellent work which has been done for economic entomology by Miss Ormerod, particularly in England, but also in many other parts of the world, is well known to every one. Her valuable annual reports are eagerly looked for every year by all interested in the practical application of the study of insects for the prevention of their injuries to crops. We have just received from this talented authoress another evidence of her unselfish labours for the good of her countrymen. The above named volume is in reality a compendium of the original observations made during the last twenty-one years by Miss Ormerod and her correspondents, together with the latest results and the most approved remedies for the various pests of large and small fruits.

As in all former publications bearing Miss Ormerod's name, the arrangement of the subjects, for convenience of reference, the presswork and the general get-up of the volume, bear the stamp of a most careful and tasteful masterhand. The different fruit crops treated of are: Apple, cherry, currant, gooseberry, medlar, nut, pear, plum, quince, raspberry and strawberry. At the end is a list of the fruit crops infested by insects with the names of the insect infestations; the subjects are arranged alphabetically; and after the name of each tree or crop mentioned in the work the names of each of the infestations to which it is liable in England are classified under subordinate headings as Bark, Blossoms, Fruit, Leaves, Shoots, Wood according to the nature of the attack. The insects are given with their scientific and popular name and so far as possible are arranged together as to kinds, as Aphides, Beetles, Moths, etc., with the number of the page of the detailed observation in the volume. In four instances where the pests are causes of much mischief to several kinds of crops, the infestation appears under its own name. These exceptions are Earwig, Red Spider, Root-knot Eelworm and Wasps.

Particular mention must be made of the excellence of the illustrations which seem to be perfect types of what such illustrations should be in works on insects for the use of practical fruitgrowers. J. F.

THE BUTTERFLY BOOK, a popular guide to a knowledge of the Butterflies of North America, By W. J. Holland, D. D., Chancellor of the Western University of Pennsylvania, etc., Pittsburg, Pa. One vol. 4to., pp. 382. [Price $3.00 postage prepaid. Copies may be procured from the Author, or William Briggs, 29-33 Richmond Street, West, Toronto.]

It is with great pleasure that we announce the publication of this beautiful popular book on the Butterflies of North America Hitherto the vast number of young people who begin collecting insects have had their enthusiasm sorely chilled by their inability to find names for their specimens and have soon given up the pursuit in despair. Now, there need be no difficulty as far as the butterflies are concerned. In the handsome volumn before us there are no less than forty-eight beautiful colored plates, produced by a new process from photographic representations of specimens from the Author's cabinets and on them are depicted over a thousand butterflies, belonging to 527 species. The colors are remarkably true to nature and a child should have no difficulty in identifying any specimen that he may capture from the plates alone. In the letter press brief de

scriptions are given first of the characteristics of the genus, in all its stages, with a wood cut shewing the neuration, and then of each species, setting forth the colours and markings, size, &c., of the butterfly, the early stages where known and the geographical distribution; references are also given to the works of Edwards, Scudder and other authors, where fuller information can be obtained. As an introduction to the work illustrated chapters describe in a popular and interesting manner, the life-history and anatomy of butterflies, how to capture, prepare and preserve specimens, their classification and the principal books that have been published upon them in North America Interspersed through the volume are short papers for the most part of an amusing character in which the author varies the monotony of descriptive matter by telling some of his experiences or relating some interesting facts regarding these beautiful creatures. We heartily commend the work to our readers and earnestly hope that it may become widely distributed amongst all lovers of nature throughout North America. C. J. S. B.

WILLIAM HAGUE HARRINGTON, F.R.S.C.

One of the excellent portraits prefixed to this volume is that of Mr. William Hague Harrington, one of the ablest entomologists in Canada. He was born at Sydney, Cape Breton, on the 19th of April, 1852, and received his early education first at a private school and subsequently at the Sydney Academy, where he distinguished himself by close application in all the lines of study, and particularly in mathematics. In 1870 he removed to Ottawa and on the 30th of November of that year was appointed to a clerkship in the Post Office Department, where he has remained ever since, gradually rising until now he is chief clerk in the money order branch. Mr. Harrington has always been an enthusiastic naturalist and in 1879 he joined with his friend, Dr. James Fletcher, in the formation of the Ottawa Field Naturalists' Club, and has continued to take an active interest in it ever since. During the same year he was elected for the first time a member of the Council of the Entomological Society of Ontario, and has continued to hold some office in it ever since; in 1884, 5 and 6 and again in 1892 he was its delegate to the Royal Society of Canada; in 1891 Vice-President and from 1893 to 1895 President of the Society; for some years past he has also been one of the Editing Committee of the *Canadian Entomologist.*

Beginning with the year 1879, he has been a regular contributor to these Annual Reports. Among his more important and valuable papers may be mentioned those on Elateridæ (1879), Rhyncophora—Weevils (1880), Some Fungi-Eaters (1881), Long-stings, House-flies, Chrysomelidæ (1882) Insects affecting Hickory (1883, Saw-flies (1884), Ants, Wasps and Bees (1885), Insects infesting Maple-trees (1886), The nuptials of Thalessa (1887), Insects affecting willows (1889), Hymenoptera Parasitica (1890), Notes on Japanese insects (1891), Uroceridæ (1893), Notes on Canadian Coleoptera (1894), Winter insects from Swamp-moss (1895) Beetles on Beech (1896), and his Presidential Addresses in 1893 and 4. During all these twenty years he has continually furnished papers of a more technical and scientific character to the pages of the *Canadian Entomologist*, and has described a considerable number of new species of Hymenoptera. His work is so thorough and accurate that it has been awarded the highest praise by those competent to judge.

In 1894 Mr. Harrington was elected a Fellow of the Royal Society of Canada. He is now in the full maturity of his powers, and, if his life be spared, we may feel sure that the coming years will continue to bear fruit and that Entomological Science will be enriched by the outpouring of his accumulated stores of learning, experience and observation.

JOHN DEARNESS.

The other portrait at the beginning of this volume is an excellent likeness of Mr. John Dearness, Inspector of Schools for East Middlesex, President of the Ontario Educational Association, member of the Educational Council for the Province, and from 1895 to 1897 President of the Entomological Society of Ontario. Mr. Dearness was born at Hamilton, Ontario, in 1852, his parents having come to Canada from the Orkney Islands. His early years were spent on a farm near St. Marys, where no doubt he imbibed in his youthful days the love of natural history which he has cherished ever since. His primary education was obtained at the local schools, from which he proceeded to the Provincial Normal School; there he greatly distinguished himself throughout the course and left with the highest honors and certificates. He at once began his professional work as the teacher of a cross-roads log schoolhouse in the country, but was soon promoted to be principal of a village school and then of a town school; after a brief period in a high school he was appointed to the important position of inspector in 1874, having gone through all these gradations of scholastic work in the marvellously short space of three years. He has now been performing the duties of an inspector for nearly quarter of a century, and is also Lecturer on Botany and Zoology in the Western University of Ontario at London. He was one of the editors of the series of "Royal Canadian Readers," and in 1896 was appointed a member of the first Educational Council of this Province.

Though his life has been so fully devoted to educational work, Mr. Dearness has yet found time for the practical study of natural science, especially of mycology, and has applied his leisure hours to the formation of a collection of fungi, which is unsurpassed in Canada, containing as it does a very large number of species new to science. For many years he has taken a warm interest in the Entomological Society of Ontario and since 1892 has held an official position upon its Council as Director, Vice-President and President. His addresses when filling the presidential chair have been published in these Annual Reports and must be familiar to our readers; they treat to a large extent, as might naturally be expected, of the educational value of natural history and the methods by which the study of insects can be successfully introduced into country schools. His scientific writings, however, have consisted for the most part of papers read before the Microscopical and Botanical Sections of the Society and have treated of toadstools and mushrooms rather than of bugs and butterflies. Being of the same age as Mr. Harrington and full of health and vigor, we may form similar expectations of his future work in his chosen fields of both science and education.

C.J.S.B.

AN ACT TO FURTHER IMPROVE THE SAN JOSE SCALE ACT.

Assented to April 1st, 1899.

Her Majesty, by and with the advice and consent of the Legislative Assembly of the Province of Ontario, enacts as follows:

Short title.

1. This Act may be cited as *The San Jose Scale Amendment Act.*

61 V. c. 33, s. 7 amended.

2. Section 7 of *The San Jose Scale Act, 1898*, is hereby amended by adding the following sub-section:

Destruction of diseased plants.

(*a*) If, in the case of an orchard or collection of plants, the inspector finds scale on plants located in several different parts of the orchard or collection, and decides that it is advisable in the public interest to destroy all the plants in such orchard or in any part or parts thereof and so reports to the Minister, the Minister may direct that an examination or inspection shall be made by an additional inspector, and upon their advice in writing he may direct that all the plants in such orchard or such collection of plants or in such part or parts thereof shall be destroyed without requiring that every plant in the said orchard or collection shall be first examined.

Plants to be fumigated before leaving nursery.

3. The owner or proprietor of any nursery shall not send out or permit any plant to be removed from his nursery without the same being first fumigated by hydrocyanic acid gas in accordance with regulations prescribed by order of the Lieutenant-Governor-in-Council.

Sale of plants before fumigation prohibited.

4. No person shall sell or dispose of or offer for sale any plant obtained, taken, or sent out from a nursery unless the said plant has previously been fumigated in accordance with these regulations.

Scale in a nursery—stock not to be removed without leave of Minister.

5. In case the inspector finds scale in any nursery and so reports to the Minister, the Minister may thereupon inform, by writing, the owner or proprietor or manager of said nursery of the existence of scale in his nursery, and the owner or proprietor or manager of said nursery shall not thereafter permit any plant or plants to be removed from the said nursery until he is notified in writing from the Minister that the inspector has reported to the Minister that it is safe in the public interest to permit the said nursery stock to be removed after fumigation.

Act incorporated with 61 V. c. 33

6. This Act and *The San Jose Scale Act, 1898*, shall be read and construed as one Act.

(For the San Jose Scale Act, 1898, see Report of 1897)

REGULATIONS FOR THE FUMIGATION OF NURSERY STOCK.

Toronto, April 7th, 1899.

The following regulations have been prescribed by Order of the Lieutenant-Governor in Council in accordance with the provisions of the *San Jose Scale Amendment Act*, passed April 1st, 1899 :

1. Fumigation must be carried on in a box, room, compartment, or house suitable for the purpose, which must be air-tight and capable of rapid ventilation. The owner or proprietor will notify the Minister as soon as preparation for fumigation is complete. The Minister will thereupon order an inspection of the fumigation appliances. No fumigation under the Act is to be carried on until such inspection has been made and a satisfactory report sent to the Minister.

2. The Inspector, after examining and measuring the box or house, or other compartment in which fumigation is to be carried on, will prescribe the amounts of material to be used for every fumigation, and the instructions as to the same must be carefully followed out. The Inspector may, if thought advisable, supply the material for each fumigation in weighed packages.

3. The fumigation house (which shall include all apparatus or appliances used in the fumigation, such as generators, etc.) is to be subject to the orders of the Minister on the recommendation of the Inspector. Subject to the approval of the Inspector the fumigation house may be on other lots than those on which the nursery stock are growing.

4. The fumigation is to be by hydrocyanic acid gas produced according to the instructions of the Inspector and from such formulas as he prescribes for the purpose.

5. The fumigation is to be continued for a period of not less than forty-five minutes. After the expiration of this time or longer, and when fumigation is complete, the house is to be thoroughly ventilated for fifteen minutes at least.

6. No person is to be allowed to enter the fumigating house until after the ventilation period has expired. Entering before may prove injurious, if not fatal, as the gas is a deadly poison.

7. The fumigation of buds and scions may be done in fumigation boxes of not less than thirty cubic feet capacity, the same to be subject to inspection and approval.

8. Immediately after inspection of the fumigation house, the Inspector will report to the Minister, and the Minister or the Inspector will thereupon give permission in writing for the owner or proprietor to begin fumigation.

9. The owner or proprietor of every nursery will attach to every box and to every package of nursery stock a certificate as follows, and he will furnish every purchaser who so desires a copy of the same.

Certificate of Fumigation.

This is to certify that this package of nursery stock consisting of...............

....

....

was properly fumigated on the.........day of............, 1899, in accordance with the regulations laid down by the Ontario Minister of Agriculture. in accordance with 62nd Victoria, chapter 35.

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THIRTIETH ANNUAL REPORT

OF THE

ENTOMOLOGICAL SOCIETY

OF

ONTARIO.

1899.

(PUBLISHED BY THE ONTARIO DEPARTMENT OF AGRICULTURE, TORONTO.)

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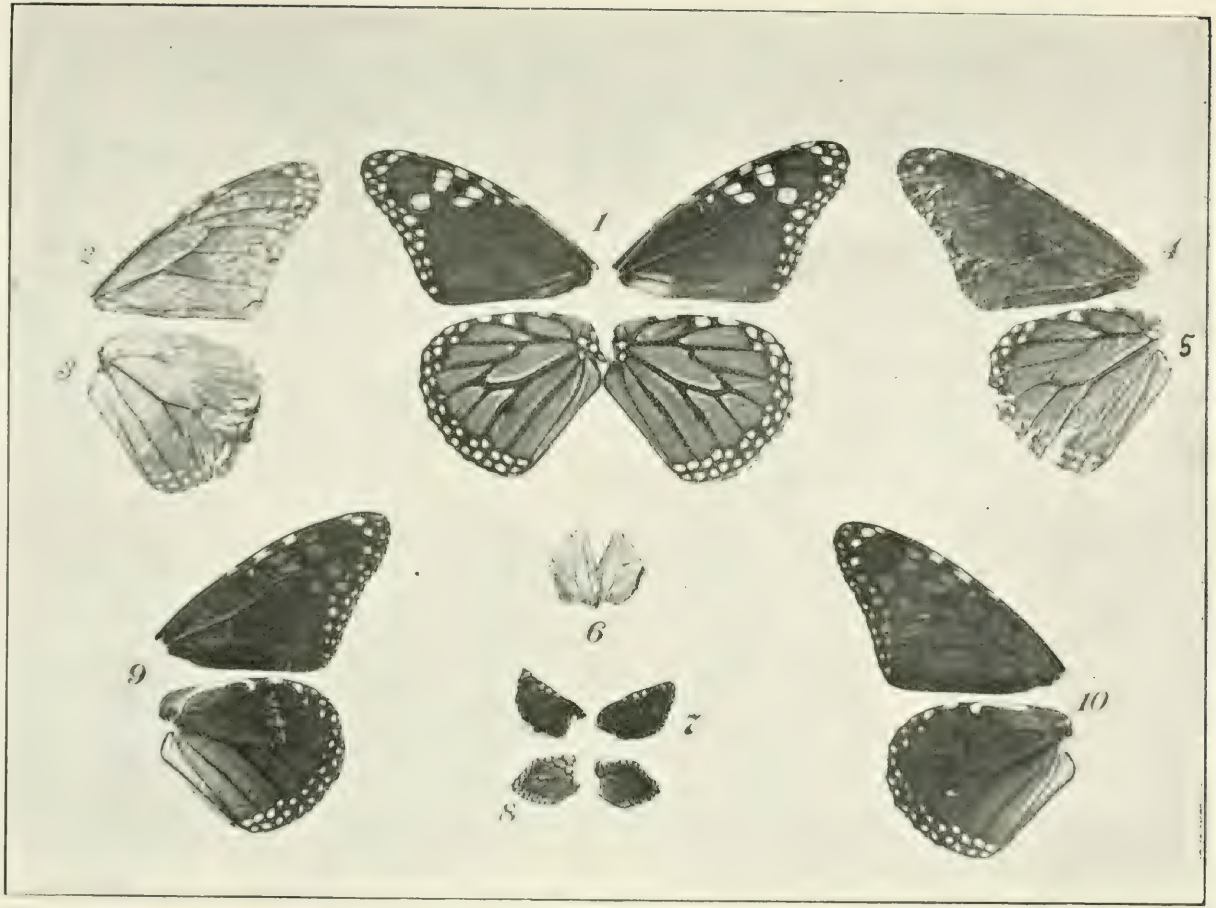

Structure of a Butterfly's Wing.

THIRTIETH ANNUAL REPORT

OF THE

ENTOMOLOGICAL SOCIETY OF ONTARIO

1899.

To the Honorable John Dryden, Minister of Agriculture:

SIR,—I have the honor to present herewith the thirtieth annual report of the Entomological Society of Ontario.

The thirty-sixth annual meeting of the Society was held in the City of London on the 11th and 12th of October, 1899, when the officers for the ensuing year were elected and the necessary business of the Society was transacted. The report contains a full account of an important conference upon the San Jose Scale, to which the first afternoon was devoted, the audited statement of the Treasurer, reports of the various branches, sections and officers of the Society, and ot the papers and addresses presented during the meeting.

The Society's monthly magazine, the *Canadian Entomologist*, has been regularly issued and has just completed its thirty-first volume. It continues to maintain its high reputation as a valuable scientific publication and to attract the contributions of the most eminent Entomologists of the day, both here and in other countries.

I have the honor to be, Sir,

Your obedient servant,

CHARLES J. S. BETHUNE,

LONDON, Ontario. Editor.

OFFICERS FOR 1899-1900.

President.—REV. T. W. FYLES, D.C.L., F.L.S. .... South Quebec.

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" 2.—J. D. EVANS .... Trenton.
" 3.—D. G. COX .... Toronto
" 4.—JAMES JOHNSON .... Bartonville.
" 5.—R. W. RENNIE .... London.

Directors ex officio (ex-Presidents of the Society) :

PROFESSOR WM. SAUNDERS, LL.D., F.R.S.C., F.L.S., Director of the Experimental Farms .... Ottawa.

REV. C. J. S. BETHUNE, M.A., D.C.L., F.R.S.C .... London.

JAMES FLETCHER, LL.D., F.R.S.C., F.L.S., Entomologist and Botanist, Experimental Farms .... Ottawa.

JOHN DEARNESS, I.P.S .... London.

HENRY H. LYMAN, M.A. .... Montreal.

Director ex-officio (Ontario Agricultural College).—PROFESSOR WM. LOCHHEAD .. Guelph.

Librarian and Curator.—J. ALSTON MOFFAT .... London.

Auditors.—J. H. BOWMAN AND W. H. HAMILTON .... London.

Editor of the Canadian Entomologist.—REV. DR. BETHUNE .... London.

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Delegate to the Royal Society.—REV. DR. BETHUNE .... London.

Delegates to the Western Fair.—J. DEARNESS and DR. BETHUNE .... London.

Committee on Field Days.—DR. WOOLVERTON, MESSRS. BALKWILL, BOWMAN, ELLIOTT, LAW, PERCIVAL, RENNIE and SAUNDERS .... London

Library and Rooms Committee.—MESSRS. BALKWILL, BETHUNE, DEARNESS, MOFFAT and SAUNDERS .... London.

THE ENTOMOLOGICAL SOCIETY OF ONTARIO.

ANNUAL MEETING.

The thirty-sixth annual meeting of the Entomological Society of Ontario was held in the rooms of the Society, Wellington Street, London, on Wednesday and Thursday, October 11th and 12th. The Council met on Wednesday at 11 a.m. for the purpose of preparing its annual report and transacting the ordinary business of the Society. At the request of the President, Mr. Henry H. Lyman, of Montreal, the chair was occupied by the Rev. Dr. Bethune, of London The following additional members were also present: Rev. Dr. Fyles, South Quebec; Dr. James Fletcher, Entomologist and Botanist, and Mr. Arthur Gibson Assistant Entomologist, Experimental Farms, Ottawa; Professor Lochhead, Ontario Agricultural College, Guelph; Messrs. W. E. Saunders, J. A. Balkwill, R. W. Rennie and J. Alston Moffat, London. Letters expressing regret at their inability to attend the meeting were received from Mr. W. H. Harrington, Ottawa; Mr. J. D. Evans, Trenton; Mr. G. M. Stewart, Secretary of the Toronto Branch; and Mr. Dwight Brainerd, Montreal.

The President brought up the subject of members' subscriptions that are in arrears and gave a tabulated statement of those in this position. After some discussion a by-law was adopted in which instructions are given to the Secretary for dealing with all such cases, and if necessary, discontinuing the sending of the Magazine and Report.

Dr. Bethune drew the attention of the Council to the fact that the membership of the Society had so largely increased during the last few years that the number of surplus copies of the *Canadian Entomologist* had become alarmingly small. He presented a tender from the London Printing and Lithographing Company, and it was decided to increase the monthly issue by one hundred copies, beginning with the number for January, 1900.

The report of the Council was then prepared, and after the transaction of some further details of business, the meeting adjourned.

Conference on the San Jose Scale.

The Society met at 3 o'clock on Wednesday afternoon, October 11th, for the purpose of holding a conference on the all-important subject of San Jose Scale. The following members were present, in addition to those already mentioned: Prof. C. C. James, Deputy Minister of Agriculture for Ontario, Toronto; Inspector G. E. Fisher, Freeman, Ont.; Prof. F. M. Webster, Wooster, Ohio; Messrs. J. Dearness, H. Gould, J. Law, J. S. Pearce, W. Percival, H. S Saunders, Spencer, Dr. W. J. Stevenson and others. The chair was taken by the President, Mr. Henry H. Lyman, Montreal.

The Chairman: I have much pleasure in welcoming you to this 36th annual meeting of the Entomological Society of Ontario. We are particularly fortunate this year in having a number of distinguished entomologists with us. We had hoped to have the pleasure of welcoming the Hon. Mr. Dryden, Minister of Agriculture for Ontario, but unfortunately he has been unable to attend, but he has sent his Deputy, Prof. James, whom we are all very glad to see. We also have Prof. Webster, who has taken the trouble to come from Wooster, Ohio, to be present, as well as Mr. Fisher, Inspector of San Jose Scale for Ontario; Prof. Lochhead, of the Agricultural College, Guelph, and others, so that our meeting ought to be a particularly important and useful one, but as I unfortunately labor under the infirmity of deafness, I will call upon our Vice-President, Rev. Dr. Fyles, of Quebec, to take the chair and preside over the meeting

REV. DR FYLES: I am very sorry that our worthy chairman is afflicted with deafness. I am very sorry on my own account. I would wish to express the very great pleasure I feel on seeing so large a gathering to-day, and I may say a gathering of distinguished men. We have a very important subject to consider—that of the San Jose Scale insect, which is doing so much damage in the United States and in Canada.

I am happy to say we have an authority on this destructive insect in Prof Webster, from Ohio, who will tell us about the pest and his experience in connection with it. We have also our own Dominion Entomologist, Prof. Fletcher, who has given much attention to the scale, and I trust we shall all benefit by the opinions that these gentlemen can give us. There are others who will be able to speak upon the subject under consideration, and I will now in the first place call upon Mr. Dearness to commence the discussion on this interesting subject.

MR DEARNESS: Mr. President and gentlemen. Yesterday evening I was asked to open the discussion on the San Jose Scale insect. I was aware that my name was on the programme, but I did not expect to have the honor of opening the discussion. I have hastily jotted down some notes by way of introduction.

Nineteen years ago Prof. Comstock published descriptions of a number of Coccids in the Genus Aspidiotus, one of which he very appropriately named *A. perniciosus.* The first American home of this scale is supposed to have been in the San Jose Valley, California, and hence the popular name of the species. No one knows how long it had inhabited the fruit trees in that district before Prof. Comstock labelled it. One doubtful theory is that it had been introduced ten years before that time from Chili. It is pretty well settled that it is now about thirty years since its effects on deciduous fruit trees were first observed in California. Singularly enough according to Prof. Comstock's information the peach and apricot were exempt from its attacks. In Canada and the United States, if it thrives particularly well on any kind of tree, it is on the peach. Earnest efforts have been made to fix the date of its introduction to the Eastern United States. It seems established that the first extensive distribution of it was by the Californian nursery stock sent out by two firms in New Jersey twelve years ago.

This summer an unsuccessful attempt was made to fix the date of its importation to Ontario. It may be that some of that 1887 New Jersey stock found its way here. A trustworthy and observant fruit grower, Mr. John Vanhorn, of Chatham, testified this summer that he detected this scale in his orchard six years ago, the suggestion to look for it having come from a New Jersey nursery firm—the Parry Brothers—with whom he had had dealings. It is not out of the range of probability that it was introduced into the southwestern part of Kent county ten or twelve years ago.

From the scientific point of view the *Coccidae* are an interesting and attractive family of insects. It is also a large family. Although it cannot be said to be well worked up, Prof. Cockerell's check-list published three years ago gives 770 species, to which his supplementary list, published this year, adds 322 species. More than a third of these additions are in the section *Diaspinae*, to which the San Jose Scale belongs.

Some of these may yet, when they go abroad, rival the San Jose in destructiveness. Several of them are capable, and guilty too, of killing the plant upon which they feed, but at present and for the past five years the San Jose overshadows all its relations in economic interest on account of its destructiveness, The sagacious Comstock nineteen years ago declared it as his belief that it is the most pernicious scale insect in the country.

What makes it so pernicious? Several other species are as strongly armored. Its larvæ are longer exposed than many others. It does not seem to set up a morbid condition of the tissue of the plant on which it feeds; like its congeners, it simply sucks the sap of its host. (It is true that its presence it characterized in some kinds of wood by a reddening of the subcuticular and cambium layers, but there is no distortion of the tissue as in the case of tissue affected by black-knot.) A gravid female does not contain nearly so many ova as a *Mytilaspis.* As a rule an insect that winters in the egg state, as the

oyster-shell bark-louse does, is safer than one that hibernates. What then gives the San Jose Scale its pre-eminence among its brethren as a plant destroyer?

First, it is the difference between addition and multiplication. A single brood of 600 is left far behind by a three or four-generation multiplication of even 50 or 60 In Ontario the over-wintered San Jose females begin bringing forth their young about the 20th of June. If by the 15th of July each of these over-wintered ones has produced 30 females, these are by the the latter part of August ready to produce say 50 each (the later mid-summer broods are said to number 200 to 300 females from each mother) giving a total of 1,500, and each of these 1,500 by the early part of October is multiplying by 50, totalling for the single season, in Ontario, a progeny of 75,000 females from each individual female that survived the winter.

It is probable with us that there are three full generations in a year. The possible ratio of multiplication is probably nearer 100 than 50. (It is said to be between 200 and 300 in the latitude of Washington). A ratio of 100 for three generations would give a total of a million. On trees in certain conditions and of varieties that have resistant bark, probably only a small proportion effect a connection with the sap channels necessary for them to complete their life cycle. There is pretty good evidence that a susceptible young tree may be overrun and literally sucked to death in three years. On the other hand, the increase of the insect on trees of a susceptible kind has in some cases been very slow. Mr. Honner, Amherstburg, testified that on a young peach tree in his orchard the scale had been most certainly established three years and yet in that time it had spread over but a small part of the tree.

Secondly, the comparative activity of the larvae and their plumpness at birth enables them to scurry around a considerable distance and to subsist a relatively long time before they perish for lack of food.

Third, its lack of fastidiousness in the flavor of its nourishment. Trees, shrubs, herbs, foliage, fruit and roots are neither common nor unclean to it. Mr. John Gordon, of Guilds, whose story of his efforts to save his orchard from the officers of the law, was truly pathetic, has spent time and effort without stint in studying and experimenting upon the insects in his neighbors' orchards since his own was burned. He showed Mr. J. H. Smith, B.A., and me, examples of the settlement of the insect and the secretion of its scale on fruit of watermelon, root of carrot, fruit of squash, leaves of poison ivy, garden phlox, high-brush cranberry, and hemerocallis. Besides some of the above he had artificially inoculated mulberry, basswood, blue beech, red beech, ironwood and elm. We found on September fourth and fifth, breeding females on hemp, pitch forks, rhubarb, burdock, horse-radish, erect door weed, oriental polygonum, hedge mustard, turtle-head, nettle, touch-me-not, potato, white ash, willow, nine-bark, rose, elm, basswood, currant.

The almost continuous running of the larvae, owing to the fact that they are produced singly over a period of several days, offers the means of their distribution by nesting birds, strong winds, horses and workmen engaged in the orchard, and fruit harvesters.

The desirability, nay the necessity, of checking, eradicating or controlling an insect so fecund, so omnivorous and so destructive as the San Jose Scale is at once impressed by a knowledge of its habits and capabilities. The usual restriction of animal life to its peculiar faunal zone makes some biologists hope that in our latitude this insect, even if let alone, could not become so destructive as in the latitude of Maryland. The extreme severity of the winter of 1899 proves that prolonged zero temperature, while it may weaken and check it, will not eradicate it. Its allies on our fruit trees are usually held in check by parasitic insects. In the trip just referred to, Mr, J. H. Smith and I were shown two trees the worst infested I ever saw with *Chionaspis*. Here and there were groups of the spinulous sloughs of *Chilocorus*. The owner informed us that there had been a great many more of those, but he had brushed them off and killed them. As frequently happens in insect fighting, he was spending his efforts in killing his allies. In one sample of Putnam's scale that I found on hickory, nearly every shield was perforated and its contents devoured by some insect.

I have not seen anything like this degree of havoc by parasites among the San Jose scale, yet it doubtless has its foes among both insects and fungi. Prof. Forbes, State Entomologist of Illinois, reports in Bulletin No. 56, that he has discovered in *Sphaerostilbe coccophila*, Tul. found by Prof Rolfs on the oak scale in Florida, an efficient fungous disease for the San Jose species. Most of the bulletins report that a little coccinelid beetle, *Pentilia mesilla*, preys actively on the San Jose Scale, and also that in some localities the twice stabbed lady-bird, *Chilocorus bivulnerus* has literally cleared the tree of the scale. Certain species of mites also prey upon it. On specimens collected in South Kent, I found a mite apparently feeding on the scale which Mr. Marlatt pronounces a species of Rhyncholophus and another much more common not yet determined.*

Mr John Gordon, above cited, has been experimenting with the application of hot steam and a small proportion of coal oil. He is making use of one of his neighbor's trees that was nearly killed with the scale as an example of this method of treatment. (Specimen cuttings from this tree were exhibited. Branches cut off before the treatment still had numerous young scale larvæ running over them; while upon cuttings taken from the treated branches no surely living scale could be found.) Mr. Thonger assured me that Dr. Fletcher had reported 97 per cent. of the scale dead on the samples taken from the trees he had treated with a mechanical mixture of coal oil and water. The machine mixes the oil and water in definite proportions at the nozzles and projects the mixture as an "atomized" spray. Mr. Thonger seems to have confidence that if he had been allowed to repeat his spraying with the coal-oil mixture he could have eradicated the scale from his orchard.

Up to the present time the most successful and satisfactory method of remedial treatment is the fish-oil and potash soap solution. This is a soft soap made with a special fish-oil and strong caustic potash, dissolved in water in the proportion of two pounds to the gallon. Accounts of the demonstration of the success of this kind of treatment on a large scale as made at Catawba Island, Ohio, under the direction of Prof. F. M. Webster and Mr. Willis H. Owen have been published and extensively circulated.

As Prof. Webster is here to-day I will leave it to him to describe the treatment and its results. The potash soap treatment was found to affect the trees so favorably there that growers who had not the scale in their orchards have used it generously. Mr. Owen said that over 17 tons were used last winter on an area considerably less than 1,000 acres. Mr. J. W. Gamble, President of the Ottawa, Ohio, Horticultural Society, for his annual address, read a paper entitled "The San Jose Scale as a Blessing in Disguise." His argument was that the scale had indirectly led the growers to discover the value of the soap as a general cleaner-up and fertilizer of their trees, and on peach-trees it had checked the destructive leaf curl.

When the scale was first discovered in Ontario, the people thought it was confined to two or three situations and within narrow limits at these places. Had that been the case no wiser course could be taken than to cut down and burn the trees It soon became evident that it was much more widely established than at first suspected. The axe and fire is a primitive method of treatment for insects. Here is one that lives on the surface and has not the power, save in a restricted degree for a short period, of moving its position Surely science will not remain helpless and useless to kill that exposed insect and save the valuable tree upon which it feeds. In several instances more money has been spent in going over a tree with lenses to discover whether the scale was on it than it would have cost to spray it thoroughly. Drenching with the spraying machine will reach the parts that the lens will miss. The axe and fire method is dependent on the discovery of the insect and discovery is not always possible. Several other species of scale are liable to be mistaken for the San Jose one. By the fire method mistakes are irremediable; by the spraying method no harm comes to the tree though it be drenched with soap suds for harboring one of the native species of scale.

* Respecting the last, Dr. Howard wrote on the 23rd Oct., "I have to inform you that your scale mite has been examined by Mr. Banks, and he identifies it, with some little doubt, as *Hemisarcoptes coccisugus*, Lign. If not this species it is a closely allied one and belongs to the family Canestrinidæ. The species is the only one known in the genus, and is a parasite of Coccidæ, having been found in this country on the oyster-shell bark-louse, and in Europe on other scale insects.

THE CHAIRMAN: I am sure I voice the feelings of the meeting when I say we are very much obliged to Mr. Dearness for his carefully prepared and interesting notes. This Scale Insect is a most disobliging insect. I think with such a choice of fruit trees it should leave other trees alone.

MR. FISHER: What progress did this scale appear to be making on those trees, other than fruit trees, which had been artifically inoculated?

MR. DEARNESS: Those that had been artifically inoculated had not had time to mature when I saw them. They were only in the stage of brown and yellowish round scales.

MR. FISHER: Have you ever found scales on trees that had not been inoculated that appeared to be doing well?

MR. DEARNESS: On the Spiraea we found it doing well.

MR. FISHER: Is that a forest tree?

MR. DEARNESS: That is a shrub; and we found it growing on the elm and basswood but not doing so well as on the fruit tree.

MR. FISHER: In this connection I understood there was a feeling that the Scale would flourish on the shade trees in the city of St. Catharines, and we made a very careful examination of the shade trees last year. We spent quite a number of afternoons inspecting the trees, with the result that we could not find any trace of the San Jose Scale on these trees notwithstanding that the neighbouring gardens were very badly infested. This year I thought it only fair there should be a further examination made as we found the Scale spreading to much more distant points, and yesterday we made a careful examination of Rodman Street and Geneva Street, with the result that we found no Scale whatever on any of the hardwood trees. The trees along these streets are hard maple and soft maple and elm and horse-chestnut.

THE CHAIRMAN: That would seem to say that the insect preferred fruit trees.

DR. FLETCHER: Are there any fruit trees infested by the Scale growing in the neighborhood of these trees?

MR. FISHER: There are currant bushes that are rotten with the Scale.

MR. DEARNESS: In reference to that allow me to point out that Prof. Comstock speaks of peach being excepted and apricot being excepted and certain kinds of cherry trees being exempt. We found elm and maple surrounded by badly infested trees exempt. These infested trees have been infested by wind, or men working among them, or by the harvesters. The insect cannot make its connection on the trunk of a tree like the hard maple, but if these insects were brought by these agencies and put up on the top of a forest tree, I cannot see why they would not grow there.

Because a fruit tree is exempt while others surrounding it are affected does not prove that the scale won't live on it. You will find in an orchard three or four trees badly infested and other trees that you cannot see any on right in the immediate vicinity. Here is a branch of a willow that is badly infested and the whole tree was infested throughout.

DR. FLETCHER: There is no question about its attacking the elm. It is one of the characteristics of the Coccidae that you will find a single tree very badly infested, and then touching that tree will be others perfectly exempt. That simply shows that a tree in a weakened state is more apt to be attacked than in a vigorous state.

MR. FISHER: I never found elm infested.

MR. DEARNESS: Here is an elm that is infested (shewing a specimen).

DR. FLETCHER: Of course it is a new importation into Canada, and it is more likely to attack the same kind of trees that it has been feeding on, but at the same time we cannot argue that it will not work on other trees. In the first year of the introduction of the San Jose Scale into the Niagara district we could not find it on peach trees; it was

on pear and plum only; but the second year it was all through the peaches. In Kingsville likewise it was on pears and plums first, and the next year we found it on the peaches.

What is the object of this discussion: is it not to bring out the known state of affairs in Canada in connection with this insect, its distribution, abundance, etc.?

THE CHAIRMAN: Yes, and then what can be done to remedy that state of things.

PROFESSOR WEBSTER, Wooster, Ohio: I really do not know whether or not I can tell you anything new that will help you in your troubles. I have had experience enough with the San José Scale, goodness knows, but there are a lot of things yet to learn that I do not understand, and I should like to have it understood that I am not going to explain all San José Scale puzzles. I have a whole note book full of them that I cannot yet explain. You speak of the introduction of the San José Scale into Canada, but in another paper I will give you, I think that I can show you that it is not absolutely necessary to trace all introductions back to the two New Jersey nurseries. We had a nursery in Ohio of which I have never been able to find sufficient proof to convince me that there was not an introduction into that nursery before it could have been gotten from New Jersey. I cannot understand how the premises could be so thoroughly infested since that time. I have no proof of course but it has been a marvel to me and I do not yet understand it. I think I can give you some information at least that will point to a possible introduction in the east, independent of these two nurseries. In regard to the scale becoming established I will give you an illustration of a puzzle that came up. I wanted to get them into the insectary so that we could watch them closely. I planted some fruit trees in the insectary, not wishing to place the scale on those outside. I tried for two years to get the scale started in the insectary on those fruit trees, and it was only after two years that I succeeded. Three times I got limbs from infested trees outside, brought them in, tied them to the trees but we could not get one of those rascals to get off the old original limb and settle down where any sensible insect would. Another instance: I know of a row of peach trees where the pits were said to have been planted where the trees were growing, and about two and a half feet upward from the surface of the ground the trunks were totally crusted with scale. After a half hour's search I could not find a single scale on the limbs, and an apple whose limbs intermingled with those of the peach had no scales on it whatever. There were no infested trees near by.

As to natural enemies I have not found any in Ohio that give any hope what ever of any immediate relief. I suppose that in the course of years our native insects will prey upon it but they have yet to cultivate an appetite for it, just as we do for our oysters. I noticed the little black *Pentilla* very abundant in the orchards of northern Ohio last fall, but this spring I found that they had evidently been killed off by the winter just about in proportion as the scale was destroyed, so that the problem is in precisely the same position that it was before. This year there are not more than half as many of the natural enemies as there were last year. Speaking of the elm, if is is not burnt I can send you a section of an elm tree that is as badly infested as any fruit tree I ever saw, but I have not generally found it as abundant on the elm as on the fruit trees.

MR. FISHER: Do you find it often on the elm?

PROFESSOR WEBSTER: I have found it bad in the nurseries and have found it in a small orchard growing up in the midst of the woods, where the young elm shoots were growing up from the old roots, these shoots being pretty badly infested with it. Whereever I have found elms intermingled with infested fruit trees, I have found the elm more or less infected but not always as badly. The first experience I had with the scale was in December 1894, when it was sent me from an orchard in southern Ohio, and the trees were very easily traced back to the nursery where they were grown. The first infested trees sent out from that nursery were not peach, because the peach stock was grown in another part of the premises and they were not infested, the points of infestation being near where the apple, plum and pear stock were grown, but since that we found it upon the peach. I did not know what was best to do at the time and the owner was in a desper-

ate state of mind and asked me if he could put kerosene on the trees. I told him he might if he wanted to but I thought he would kill the scale and presumed he would kill the trees also. He used kerosene thoroughly and, fearing that he had not been thorough enough, he used it a second time and I told him he had probably fixed the scale and his orchard too. I was surprised on learning that he had not killed his orchard, and the fact gave me hope that we might expect something from the application of pure kerosene. Some other experiments were made that did not turn out as favorably, as we killed the trees and since that I have been wondering why it would work satisfactorily one time and the opposite way at another. My assistant has applied kerosene to the same kind of trees, using the same brand of kerosene, and in one case it caused no injury and in the other case it killed the trees.

THE CHAIRMAN: Did he kill the insects in both cases?

PROFESSOR WEBSTER: Yes, he killed those that he reached. In some cases there would be individuals that were behind a bud, or behind some loose bark where he could not reach them, and I should not expect that a single application of anything, except fire, would kill every insect on a tree. Later, while dealing with the Catawba Island outbreak, we heard considerable about whale oil soap, and we used both kerosene and whale oil soap. The fruit commissioners got together and divided the trees into three grades. The first, comprising such as seemed to be too far gone to do anything with whatever, were cut down and burned. Then there were quite a number where it seemed as though, if we could destroy the scale at once, there might perhaps be a chance to save them, and I told these people that I would not be responsible for the results, but they might try kerosene: if there was any benefit to be gained they would get it, and that they could not do any more than destroy the trees and these would have to be destroyed anyway. In some cases the kerosene resulted fatally and, of course, that added to the number of trees that were destroyed. The other grade were such as were not so badly infested but what it seemed they might be saved, and on these they used whale oil soap.

Now, they have not exterminated the San José Scale on Catawba Island by any means. They have in this way simply got it under control by the use of whale oil soap. If the people persist in a proper way I think it can be exterminated. As it is they have simply reduced the pest to a point where they can control it; but just as sure as they give that over for a single year it will come to the front, and I think if they were to allow their premises to go two or three years there would be a great many trees that would not be worth saving.

PROF JAMES: Has the fact of its being an island helped very much?

PROF. WEBSTER: I do not think so. The place is called an island by courtesy. It is only separated from the mainland by a swamp. There is really no bed of water between the island and the mainland. I do not think that has any effect at all. I do not see why they should have better results there than any place else if the same means were used. We have no law in Ohio that is good for anything. We have a law, relative to the suppression of peach yellow and black knot, and our Legislators thought it would be better to patch up the old law, and sandwich in a paragraph relating to the San Jose Scale, than it would be to make an entirely new one, and the consequence is we have a patched up law that is worthless, because no one understands or dares to attempt to enforce it.

All that has been done since 1894 has been by persuasion on my part, the only authority I have being that of referee. If there is a question between the Fruit Commissioners and the owners of an orchard, it has to come to me, and as my decision is final, there do not very many of these questions come before me. That is the reason why they had such good results out at Catawba Island. Mr. Owen was sharp enough to throw the whole responsibility on me, and he would tell these people that my decision was final and that would settle it. What has been done there, has been done by the persistent use of fire and whale oil soap, and appealing to the people to do the same thing and at the proper time. There is as much in that, or more than in anything else. It is not so much what the scale will do as we know that pretty well, but what the people will do with the scale.

I believe it can be exterminated, but it will take a great many years, and the control of treatment must be in the hands of some one man, and that man must not have a great many neighbors.

PROF. JAMES: What would you have that man do?

PROF. WEBSTER: I would put the whole matter of treatment and everything connected with it into his hands. If in some cases he saw fit to let the owner do the work, well and good, but he and not the owner should be held responsible to the Government.

THE CHAIRMAN: I suppose you mean he would have to be protected from his neighbors.

PROFESSOR WEBSTER: I guess if you would give him authority enough he would protect himself. If people come to learn that he can do the work better and cheaper than they can, there will be no trouble.

PROF JAMES: You would not leave the treatment to the owners?

PROFESSOR WEBSTER: I would leave no treatment to anybody except the one person whom you make responsible to your Minister for its being done properly, at the proper time, and if it is not, hold him alone responsible for it. If you put this work in the hands of the public you will get nothing done, even among very intelligent people We had an experience of that last week in fumigating nursery stock. A nurseryman wanted me to let my assistant go down and fumigate his stock. I told him if they would get everything ready, so that my assistant could get on with the work just as soon as he reached his destination, and go away just as soon as the work was done, I would let him go. He went down there, and he said they had a fumigating house that he could drive cats through. It was not at all adapted to the use for which it was intended and he compelled them to line it, and then they declared that it was absolutely tight, but after he started work and went outside he said the odor of the gas was very strong and they had to line it again. That shows how far you can trust people who are supposed to be rather above the average farmer and fruit-grower in intelligence. You must have some one person who does understand and make him responsible, and then see that every man has the proper measures and that they are applied in the proper way and at the proper time.

PROF. JAMES: Have you any regulation whereby you can decide whether a tree ought to be taken out or fumigated?

PROFESSOR WEBSTER: No sir, you must see the tree yourself. There are some varieties of trees that are almost worthless, and that would make a great difference. There are so many of these matters to look into that your chief officer must be on the ground and understand the situation in order to be able to decide. I do not know how it is in Canada, but in the United States there are some trees that were not worth ten cents before the scale came on them, but became suddenly valuable about the time they were to be destroyed.

As to the time, I have never found that we could do much except during the winter and spring. Summer treatment would only apply to the young scale. I do not believe you could apply anything to the trees, in the summer, that will destroy very many more than the young, without injury to the tree. During the winter season, when the foliage is off, of course, you have a much better opportunity of reaching the trees and the limbs, and with the exception of the peach you can use a much stronger mixture. You can then use a mixture that will penetrate and kill the scale. With the peach you can do this also, but it will destroy the fruit buds unless it is applied just when the buds are putting out in spring. There is a time just when the fruit buds are being put out when we can use the ordinary mixture, two pounds of whale oil soap to a gallon of water, without injury to the fruit buds.

I urged Mr. Owen to go to work and manufacture a soap that would be of a uniform grade. The great difficulty has been that we would use a certain brand of soap and it would seem to be thoroughly effective and not injurious, and I would recommend that same brand for some one to use and they would get entirely different results, and these brands do not, as a rule, analyze alike; so I urged Mr. Owen to manufacture a soap that

we knew would be of a uniform strength, and he has done so. I do not know that it varies particularly from Mr. Good's soap, only I believe it is more reliable, that is all.

PROF. JAMES: Has all the treatment on Catawba Island been under your directions?

PROF. WEBSTER: Not lately; I have not had very much to do with it the last year. The most that has been done the last year has been done independently by individuals. Of course, they brought a good deal of pressure to bear on those that were delinquent. I have had very little to with it after the scale was once gotten under control.

THE CHAIRMAN: It seems to me that we have come to these particulars through the able address of Prof. Webster. That the right remedy is whale oil soap, that should be applied in the winter and in the case of the peach when the tree is about to bud. What is necessary is a strong pull and a long pull and a pull altogether, or else that some one, with considerable powers of coercion, should be appointed to see that the fruit growers do their duty.

MR FISHER: I would like to ask Prof. Webster what additional benefits seem to result from the use of whale oil soap for the destruction of the scale.

PROF. WEBSTER: It is claimed, and I think with reason, that it acts as a fertilizer, and I would simply say that, to my certain knowledge, it has done so in some of our nurseries. It has been used a good deal stronger than was necessary in some of our nurseries, and when I asked why it was being used so strong the reply was that the stock that had been treated was a great deal more thrifty and in a great deal better condition than the untreated stock, and it was a question if it did not pay in that respect. I think as a fertilizer it has a very good effect. Some of our nurserymen are applying it to destroy the apple leaf aphis.

DR. FLETCHER: That is the potash?

PROF. WEBSTER: Yes, the potash, and, possibly, the fish oil also. Fish is a good fertilizer. I do not know to what extent it is a fungicide, but I do know that trees that were treated in the spring were exempt from the peach leaf curl, where the same variety, untreated, in the same row in the same orchard, was badly affected and the fruit nearly all destroyed. So, as a fungicide, to that extent it is certainly a very great benefit. This, and the fertilizing effects, are two very great benefits that would be gained by its use.

MR. DEARNESS: What about insect eggs on the trees?

PROF WEBSTER: That I do not know. It has been so stated, and perhaps it will prove true, that fumigation will destroy insect eggs. We have made no fumigation in orchards, but the longer we use hydrocyanic acid gas in treating nursery stock, the more we are convinced of its utility. With a proper fumigating house, and the fumigating done properly, we have never yet had a single living scale pass through the process alive.

DR. FLETCHER: How long do you keep the plants in?

PROF. WEBSTER: About 45 minutes. In regard to effect of kerosene, there was sent to me, I think two or three years ago, a limb that was cut off from a tree infested with the oyster shell bark-louse. The section sent was said to have been drenched with coal oil, but not only did the young bark lice hatch and live, but we actually got parasites from that scale after it had been treated with the kerosene.

DR. FLETCHER: Perhaps Prof. James can tell us if there are any fertilizing effects from the whale oil soap?

PROF. JAMES: Certainly not in the oil, but potash certainly would be very beneficial.

DR. FLETCHER: Is it not an expensive way of applying potash?

PROF. JAMES: Some contend it is not expensive. Last week, when I was talking to a lady who took over an old orchard near Philadelphia, she told me she started washing the trees with potash solution in order to clean the trees, and she said that the old trees that had not been bearing fruit for years commenced to bear. They seemed to renew their youth, and she said she thought it was a more effective way of applying potash to the orchard than by putting it on the ground.

Mr Dearness: There is one point that is of importance, and that is as to the time it injures the peach buds. It does not injure the buds of other fruit excepting peach.

Prof. Webster: Not so far as we have learned. There is a possibility of a similar effect on some varieties of pear.

Dr. Fletcher: It is far better to do the spraying in the spring. One of the great defects in using soap is the want of uniformity. It is simply a matter of accuracy in making it, and the soap that Prof. Webster has used is practically the same potash soap made in an accurate way, so that you can look for the same results every time.

Prof. Webster: I want to ask Prof. James if there is any way that a series of experiments could be carried out whereby we could get some definite idea, or some more exact idea, of the fertilizing value of soaps made of a certain strength.

Prof. James: That is a very difficult matter. Analyses of soils are not very satis factory, and you are experimenting with a living plant, which apart from the experiment might, or might not, produce. It is different from feeding an animal. Trees vary so much in their production, you might take a row of trees and treat them in different ways, but you are never perfectly sure.

A Member: I notified Mr. John McMechan, who was Secretary of this Society some years ago, and who is a soap manufacturer, to be present here to day, and I also asked Mr. Heard, who manufactures spray pumps, to be present, but neither gentleman is here. I thought they might have been of some benefit to the Society, or we might have benefitted them in the manufacture of their products.

Prof. Lochhead: I had the honor of attending the Commissioners during their trip to the west this summer. I was not able to be with them when they went to the Niagara District, consequently I cannot speak for that district. We saw in the western part, especially around Guilds, south of Blenheim, some effects of the San Jose Scale in several orchards. I think that even the most sanguine believer in the non-destructiveness of the San Jose Scale could come to no other conclusion but that it was a scale that was very destructive if left alone. Apparently the scale was first introduced into the Guilds District, in Mr. Warner's orchard, about six years ago, and from what I can gather, the attention of the neighborhood and of Mr. Warner himself was called to the death of some of his trees. From that orchard the scale has spread to other orchards, so that one of the most important conclusions we must come to is that the scale is extremely destructive if left to itself. Mr. Dearness has just given us very many instances of the destructiveness of the scale, and it lies with us to impress that fact upon the orchard-men of the Province. In the Kingsville District we saw one orchard, Mrs. Pulling's, originally one of the J. D. Wigle orchards, which was in a very bad condition. I did not see any dead trees, but the trees were in a bad condition. At J. D. Wigle's the scale had broken out in two or three localities; many of the trees that had originally been set out had died, and their places had been filled with fresh nursery stock. This nursery stock had not been fumigated, and consequently the infestation spread from several centres Now as to the orchard to which Professor Dearness alludes, Mr. Honor's orchard, near Amherstburg, I may say that we were driven to the orchard one fine morning, and that we a saw a splendid object lesson on the effects of whale oil treatment in an orchard infested with the oyster-shell bark-louse. The trees were large, and any observer could have told at once that they had once been in a pitiable state. I do not know whether Mr. Honor had scraped the bark-lice off or not, but undoubtedly the trees were in a good, healthy, thrifty condition at the time of our visit, and the old bark was sloughing off as if from old wounds. As a matter of fact, the trees had been almost bark-bound before. The recovery of the trees was not due simply to the death of the oyster-shell bark-lice, but it may be partly attributed to the removal of fungi and lichens that incrusted the bark, for I think very serious injury will be done to trees if lichens are allowed to incrust the bark. If the pores of the bark are stopped up, free interchange of gases is prevented, and partial suffocation takes place. The whale-oil soap solution also softens the bark so that it can yield freely to the growth of the tissues within

After this I had the pleasure of going down to Catawba Island in Ohio. There I saw another splendid object lesson in the recovery of that peach district from the

ravages of the San Jose Scale. There are three thousand acres in that island—almost one continuous peach orchard, so that there was no more favorable spot for the spread of the scale. At the begining of the experiments the owners had taken out, near the centre of the district, about three thousand trees before they began to try this whale oil soap experiment. Through the carefulness, persuasiveness and persistency of Mr. Owen, one of Prof. Webster's pupils, the fruit-men in that district were forced, in spite of themselves, to spray.

Dr Fletcher : How?

Prof. Lochhead : Some of them did not believe in the soap treatment the first season, but when they saw the improvement in the condition of their neighbors' trees they sprayed the next year. Some of these men, when they saw the great improvement that had been done, said that the San Jose Scale had been a blessing in disguise. I need not speak further along this line, but shall briefly state four very important conclusions that I have been forced to draw from the work of this San Jose Scale Commission.

First. The scale cannot be exterminated from the orchards of Ontario by the efforts of either Government or people.

Second. Any radical method that aims at extermination should be discontinued. I mean by radical method the destruction of every tree that is infested.

Third. From our experience in Ontario, and what I saw in Maryland in the spring, I conclude that the scale is not quite so destructive in Ontario as it is in Maryland. We have not had it so long here as the orchardists of Maryland have had it. We have had it in Ontario seven or eight years, and although there has been quite a number of trees killed, not more than one or two whole orchards have been killed outright ; while in Maryland one hundred acre, and two hundred acre, and three hundred acre peach orchards have been killed outright. At present we are not in a position to say whether the scale will act in that way here or not, but from what we saw in Kingsville, and from what has been seen in some other parts, it is possible it may become as destructive. I am inclined to believe that the climatic conditions will reduce to some extent the full reproductive capacity of the scale. I do not think it is possible that the scale will develope as rapidly in this Ontario climate as it will in the south in Maryland.

Mr. Dearness : It is likely to have one generation less.

Prof. Lochhead : There is one peculiar feature which inspectors have observed, and it is this, that the scale seems to gather force for two or three years without spreading, and then all at once, like a plague, it breaks out and spreads rapidly.

Fourth. The fourth conclusion is, that the scale can be held in check by the proper soap solution properly administered. I need not rehearse what Prof. Webster has said. He does not believe in letting the orchard men do this ; it must be done by a corps of men employed by a Government Superintendent appointed for carrying on this work. Prof. Webster has given plenty of evidence of carelessness on the part of orchardmen, and the Ontario orchardmen are no exception to the Ohio men in this respect. I must repeat that the scale is a most pernicious one, and to say that it is no worse than the oyster shell bark-louse, or some other pests, is an absurd position to take. Its life-history and powers of reproduction are altogether different from the other pests. It is true that the San Jose Scale is confined to the plums, pears, peaches and apples, but it has the power of reproducing on other plants, so that I cannot emphasize too strongly the fact that this scale is a most pernicious one ; and I do not think we should try to give out to the public that it is a pest at all overestimated. We must maintain emphatically that it has not been overestimated if we want to preserve the orchards. The scale is undoubtedly taking to our Province kindly. We find it in sections in the Lake Erie district ; how far north of that district there has been no chance to determine. It has also been found at Belleville, and a few miles back of Belleville. Belleville has a far colder climate than this district.

This Society should do all in its power to inform the public with regard to the presence of this pest, and I would suggest that every public school inspector in the province should

be supplied with some good samples of the scale. This action would be safe, because the San Jose Scales soon die, and are perfectly harmless on a twig which has been cut away from the infested tree. Samples should be given to every school inspector so that he could leave them with the teachers, and give them an object lesson on the scale whenever opportunity offered itself. The teachers could ask the parents to call at the school and see the scale, and in this manner the public would be informed generally as to its appearance.

The Government has to rely upon the co-operation of the orchardmen themselves for future action against the scale, and when they find that no radical method of uprooting trees or burning them down is going to be adopted by the Government, they will come forward readily and report the presence of scale to the proper authorities. It would not be difficult for Mr. Fisher to cut down a badly infested tree and cut it up into little pieces, so that thousands of these could be distributed to the schools of the province. Even if the orchardmen find something that was not the San Jose Scale, let them inform the proper authorities and get information on the subject.

PROF. LOCHHEAD then read the following:

NOTES ON THE ECONOMIC ASPECT OF THE SAN JOSE SCALE AND ITS ALLIES.

The past year, 1899, has been a very eventful one in the history of Economic Entomology in Ontario. Early in April the Legislature passed the Fumigation Act, which compelled all nursery stock, with a few exceptions, to be fumigated with Hydrocyanic Acid Gas. To carry out this process of fumigation special air-tight sheds and buildings had to be erected by the nurseryman.

The Minister of Agriculture placed the conduct of the whole affair in the hands of myself, and I at once proceeded to make an inspection of all the nurseries for the purpose of instructing the nurserymen how to build their fumigating houses and how to fumigate. The chemicals were sent out from the Ontario Agricultural College in measured quantities suited to the capacity of each house. Very careful instructions were pasted on each parcel so as to reduce the danger from poisoning to a minimum. The substances used were Potassium Cyanide, 98% pure; Sulphuric Acid, sp. gr. 1 84, and water. The quantities used per 100 cubic feet of air space in the house were 25/28 of an ounce of Potassium Cyanide, 1 1/3 fluid ounces of acid, and 2 fluid ounces of water. In this the Johnson formula was followed.

The work of inspecting the nurseries, of preparing the chemicals, and shipping them to the different places required much careful work on the part of the College authorities, for the shipping season of nursery stock was very short this year.

At the opening of the season many of the nurserymen were afraid the work of fumigation would delay the despatch of their orders, but it is believed that all received their chemicals in plenty of time, and that very few suffered from the anticipated delay by fumigating their stock.

From reports received from the nurserymen it must be acknowledged that the initial series of fumigation experiments in Ontario has been a decided success so far as the effects of gas upon the dormant nursery stock are concerned. Very few reported injury to the stock, and these few do not state definitely whether the injury was due to the effects of the gas, or to the effects of the very severe winter upon young trees.

It must be conceded that this successful initiation of gas treatment of nursery stock to prevent the dissemination of the San Jose Scale is another victory for Economic Entomology. The people are gradually being convinced that something can be done to help them in fighting pernicious insect pests.

INSPECTOR FISHER:—I came here at the request of the Minister of Agriculture only to answer any questions as to the condition of the country in regard to the San Jose Scale. It has been pretty generally discussed through the Commission and their report so that think that I can add very little to the information you have got from that source.

might say that there are only three points at which the infestation has extended to any great proportions, that of Niagara, St. Catharines and in the southern part of the township of Harwich, in the County of Kent, in the neighborhood of Giles. Outside of these there are a few other points where the infestation has spread to very narrow limits. In addition to this, and what seems to me the most important part of our work was that we were furnished with a list of the nursery stock which was supposed to be infested, in fact some of it had been found to be infested, This nursery stock was followed through every county in the province of Ontario without any exception, and last fall and this summer about one hundred points have been liberated from infestation by the destruction of these trees. We found the Scale in about one hundred places altogether and I was very much struck by a remark which was made by a gentleman living in the County of Elgin with whom a couple of Scale trees were found. He said to the young man who found the Scale and who assisted him in destroying the trees: "Young man every such case of Scale that you find, and destroy the trees, is worth to this country at least, $1,000." Figuring from that standpoint, the value of these trees and the destruction of them is worth to this country at least $100,000. We have not found Scale generally distributed outside the points I have named, and a few others where it is not widely spread.

Professor Lochhead spoke of the Scale as being in the neighborhood of Belleville,—it was found on these young nursery trees down there at Belleville. It withstood 22 degrees below zero quite safely, and at the time, I thought that was miraculous and I reported it to some of our entomologists and also to Dr. Howard of Washington who seemed to think it was extraordinary, but lately I have read a remark in a Bulletin published by Professor Newell, of Iowa, who said the scale would winter at St. Paul, Minn., where several times the mercury was 40 below zero, so that this Belleville matter does not cut any figure, and we may look for Scale in any part of this country. I believe we may look for Scale in any climate wherever trees will grow.

In the Bay of Quinte district in the County of Prince Edward, we have been examining and the examination is not quite completed, but we have not found Scale on anything but these young trees. The Counties of Elgin, Kent and Essex are being examined in the same way; in Elgin no Scale has been found except on these young trees, and in Kent we have found the Scale only in the township of Harwich and on the Town-lines on either side bordering on the township of Harwich. Then there are several points where these young trees were found and it was only at Kingsville where we found the Scale at all. I have noticed this summer that where the trees were allowed to stand and the Scale to accumulate the destruction was far-reaching and rapid. I have been astonished at the distance the Scale will go. It spreads most rapidly in the direction of the prevailing wind, and we can congratulate ourselves that in the district where it is most extensive the prevailing winds will carry them out into the lake. I think that insects carry the Scale a good deal. We have noticed in Niagara lately that owing to the exceedingly dry weather that has prevailed there, the grass seems to have lost its nourishment and the grasshoppers have taken to the trees for food. You can stand and watch them. Sometimes their flight is only for a short distance from one tree to another, at other times they will go away across the orchard. Frequently they fly for a considerable distance. Of course the Scale goes with them wherever they go. I have an idea of my own and I would like very much if some of these learned people would help me to work it out. I have been trying my best to solve the matter for myself, and I find if we put a mature male under the microscope and a little louse beside him the male is about six times as large as the louse, and I have an idea that the male Scale is responsible for distribution. They have broad strong wings and when they fly they go off with a bound, it is no feeble flight. They can go right up in the air like a lark, and I think them quite capable of carrying one or more of these mites with them; however, I have never caught them in the act, although I have spent a great deal of time trying to do so. I had a splendid specimen the other day. It is difficult to get these males where you can watch them, I found a splendid sample of Scale and I put it on a slide on the stove just a little warm and the warmth of the fire started him out and I watched the male Scale slide about on that piece of wood, and the way he figured on the stick was very instructive to

me. He moves about with a business air, he seems to think the whole responsibility of continuing the race rests upon him and he has no time to lose, and I have stirred them up with the point of my knife and watched them as they would fly as far as I could see them, and I have been surprised at the rapidity with which they can fly.

I think they will travel very much further than a few inches, I have watched them very often when they walked more than an inch in a minute. I have watched them at it many a time, and last October, about a year ago now, I was in the Wigle orchard and I found a pear tree there of which nearly the whole of the bottom had been cut away because of blight, and as a natural result of this the growth was strong. There were suckers there about that stump that reached up about six feet, and on the bottom of that young wood there was Scale. It may have been carried there by something else, but in my opinion it would be a very easy matter for them to get there from the stump of the tree, and if you reduce it to figures a little over an inch in a minute would simply mean an hour's walk to get up that stick.

I do not know how we are going to cover the ground by spraying. The past summer there is no doubt the Scale extended beyond the proportion it held at the beginning of the season. We have to spray the peach trees within how many days before blossom?

PROFESSOR WEBSTER: That would depend upon the season, sometimes it would be a very few days.

MR. FISHER: A good many instances have come to my knowledge where last year there was no Scale and now the trees are covered with scales.

MR. C. C. JAMES, Deputy Minister of Agriculture: I come, as your President stated, to take the place of the Minister who regrets exceedingly his inability to be here. I have come not to talk but to listen. As you of course are aware this subject has presented itself in very large proportions to the Department. As we went on with the work it opened out more and more, and unless you have had special opportunity of following the development, I am quite sure you have no idea of the enormous amount of work that has been done in connection with it.

The work done last year was quite extensive, and this year at least twenty-five thousand dollars will be expended in following up this microscopic insect. I do not know what we would have done if we had not had Mr. Fisher. He is one man in a thousand. We have given him the task and he has gone ahead with it, faithfully and energetically. I know that he and his assistants have been working, not simply in the day, but night and day, and the fruit-growers have been well served by him. (Applause.)

This question presents itself to the Department from various standpoints. As Professor Lochhead said, the Government cannot do everything; we can only direct matters and we hope to have the co-operation of the many persons who are interested. It seems to me that if, during the past years, we had had some instruction in our public schools as to the simple first principles of Entomology, we might have been wonderfully helped in this work. If the public school teachers had known a little more about insects, and had given the children of farmers and fruit-growers some instruction in the subject, we might have made a census of this Scale from one end of the Province to the other, and have started out on our work with more knowledge. Perhaps we would have been warned much earlier. We need more nature study in our schools.

A MEMBER: Mr. Dearness advocates that.

Mr. Dearness is one man in a thousand along that line. There are very few school inspectors who take the interest in the matter that he does. What the Minister desires at the present time is to get some idea as how to carry on this work. Professor Webster says this treatment must not be left to the individuals. Must we send out a corps of men to look after this work? How are we going to introduce this work and carry it out successfully? If it is done it must be done thoroughly. We must employ for it only men who are competent. We feel that this is a question of tremendous importance, that the fruit-growing interests have much at stake in the matter. The further we have investigated it the more we have been convinced of the enormous risks we have been

running. The Scale was here at least six years before we really found it out. That shows you how easily it can avoid the observation of the fruit-grower. If it can so readily avoid observation you can see at once that it presents a very serious problem. You have been told of only one of many things we have done. Let me add another fact. We went to the nurserymen who had unintentionally introduced infested American stock, we obtained lists of the men to whom the stock had been sold, and then we endeavored to trace every one of these sales. In some cases the stock had gone through the hands of two or three persons. All these trees were gradually traced and examined at their final location in the orchard. Take the case at Belleville. The stock had been auctioned off on the market-square and nobody knew where it had gone. That stock had to be found and most of it has been examined.

If you have any suggestions as to how this work is to be carried out, we would like to get them. Our interests and the fruit-growers' interests are the same. Some people thought we were moving too cautiously and considering personal prejudices too much; others said we were pushing on too vigorously and are asking us not to move so rapidly, to take out only those trees that are badly infested and to allow them to treat the rest. Professor Webster says that if we allow the owners to treat, nothing much will result, and that the Government must come in and do the treating if it is to be done thoroughly. What is your opinion as to what should be done? Any suggestions that will help us will be exceedingly acceptable.

Doctor Fletcher: We have had this afternoon a discussion on one of the most difficult and important subjects which entomologists and fruit-growers have ever had to deal with. It is wise, I think, that we should look at the matter squarely and find exactly where we are. We have had our society here for a great many years under the patronage of the Ontario Government, striving hard and doing good work for the country. We have done much excellent work this afternoon in this discussion. The Government has shown a manifest desire to get at the real facts with regard to the San Jose Scale, so that the wisest legislation may be enacted. To-day we have here the Minister represented and the Provincial entomologist and the Provincial Inspector of San Jose Scale, and we as a Society should recognize this compliment. These men have come here to assist in the discussion and give us the benefit of their experience in working out this problem that we have still to solve. I suppose like every other man I change my views very often. I hope so, when new evidence warrants it; but with regard to the treatment of the San Jose Scale, I have not changed much yet. If I am asked what my views are I can only refer you back to my annual reports for the last three years; every year the same thing. There is no doubt in my mind, or in the mind of any one else that understands these insects, that this scale is to-day, what Prof. Comstock said many years ago, the most pernicious insect we have ever had to deal with. As to how long the insect has been in Canada, notwithstanding all that has been said, we all know well that it was only discovered in Ontario in Mr. Vanhorne's orchard in the spring of 1897, (See Cent. Exper. Farm Rep. 1897, p. 213) and we also all know how quickly it has spread.

Now can it be treated? I acknowledge that it can be treated if—and there comes the rub—if you can get specialists to undertake the work and if you can teach the whole of the fruit-growers in this country that *they are* concerned, that the whole welfare of the country is concerned and that it is their duty to do what will give them some little trouble and expense, but will save the whole province from an enormous loss, I say you cannot do it and you will not do it yet, and I maintain that the time has not yet come when the prosperity of the whole Province should be put at the mercy of men that we know beforehand are not going to do their duty because they have not yet learned that it is necessary. This is not a time for dilly-dallying, and it would appear as if there is little choice for the Government as to their future actions. However, I consider the matter is such an important one that I shall do my utmost to show the danger which I believe exists. Is Ontario going to act in haste and allow a thing to be done that everybody should know is very

dangerous, namely, the suspending of the San Jose Scale Act, because a few people who lose a few dollars are making trouble about it? All I can say is that they will repent at their leisure. On page five of my evidence before the last Agricultural Committee at Ottawa, last spring, I spoke rather fully of this matter and I shall be glad to send a copy to anyone who wishes for one. I believe the time has not yet come when we can trust the fruit-growers to treat their trees with sufficient care for an insect like this and protect Ontario from a very great ill. Now, it is a very great ill. Mr. Fisher who is a most accurate, careful man and the one man in Ontario who has had the best chance to see exactly what the effect of this insect is upon orchards, tells us that since the Government relaxed its efforts the insect has decidedly increased.

Is the insect only to be compared with oyster-shell bark-louse? Numerous writers have written and said that it is and is only an ordinary insect. This I say emphatically is nonsense and dangerous nonesense at that. I should like to see an expression from this Society, as a Society, commending most heartily and thoroughly every step that Mr. Dryden has taken in this matter of the San Jose Scale. I did not agree with him at first, but looking back over the history of the infestation during the past three seasons and it is only three seasons, I say I do back up, most strongly and thoroughly, every step he has taken. He has been wise from the beginning, and I say this with all the light of the experience I have had, which is a great deal. I think the operations of his department are to be commended at every step, and to-day I hope that public opinion will back him up and that instead of relaxing the efforts of the department that he will continue to do good for the country as he has in the past.

Mr. Dryden would have been here to day if possible. He has sent us assurances that he could not come here on account of important business. I know personally that he had intended to be here. He has been worried and had great anxiety over this matter because he wants to do what is wise for the country and that is the only thing that has guided him in carrying out measures to protect Ontario fruit-growers, who as a whole have misunderstood him. He has taken steps to destroy all infested trees. He has appointed efficient inspectors, and I lay great stress on that title of efficient inspectors, for I believe they are efficient. I have been in consultation with them through the whole of the work and I do not remember a single serious mistake that has been made by them. Prof. Lochhead is in the same position. Prof. Webster has been consulted and I say that the work has been most remarkably accurate for it was a work of very great difficulty and I maintain that the title of efficient inspectors should be applied to our inspectors. Notwithstanding what was said by some before the commission, the work has been good and of enormous importance to this country; I say it is of enormous importance because directly the efforts to control it stopped the enemy has increased and it is now much more difficult to overtake it; however, I believe it is not impossible to eradicate it even now. I cannot see that it is impossible to eradicate an insect that is once placed under control. When you have got a thing under control it means that you can do what you like with it. When we know that the insect is practically restricted to three small areas in Ontario, I say it would be a thousand pities if the country does not back up the Minister in wiping it out altogether. Some of the owners of infested trees who hid that fact and are now complaining that the compensation is not enough, are themselves responsible for the failure to eradicate the scale. Some of the destroyed trees have been paid for to the extent of one quarter of their value. Let them congratulate themselves on having received any compensation from the Government. What takes place when we are visited by an epidemic disease? Does the Government come forward and say: You have lost three children we will therefore give you three hundred dollars? Not a bit of it. I say the fruit growers have largely themselves to thank for the danger they are in, they have bought from infested districts after they have known well that there was great danger.

Before the San Jose Scale was in this country a warning was sent out saying there was an injurious insect that we were liable to suffer from. "Don't get poor stock, or don't get it from infested localities." But when we give an object lesson the fruit-growers won't even take the trouble to walk across the road to see it. As to the treatment being

left to the fruit-growers throughout the country, if that is done by the Government it is simply throwing up the sponge, and I believe it means the wiping out of the fruit industry throughout the Niagara Peninsula for a long time, because I maintain that the San Jose Scale is still with all of our latest knowledge one of the worst enemies we have ever had to fight against.

The treatment of it, if persisted in as it must be to succeed, is expensive and more trouble than these people will go to as a class. Let me give you one instance. Every fruit-grower knows that he can save fifty per cent. of his apples by spraying to prevent the codling-moth injury. I ask you, gentlemen, to think among your acquaintances how many *ever* spray. It is true ten years ago there were perhaps not more than one hundred spraying pumps in the country; now there are perhaps a hundred thousand. That means we have some thousands of good business men who want to save their money; but are there not hundreds of thousands who don't do it, and that with a big caterpillar nearly an inch long which they can easily see? That being the case how can we expect that they will do it with an insect you cannot see, except by the use of a microscope, even when the trees are swarming with them?

I agree with Mr. Lochhead in everything he said. The Scale is not quite so destructive in Ontario as in Maryland. I have here a photograph of an orchard of 28,000 trees, absolutely destroyed in three years from the time they were infested. What was the value of these trees? An average of $5.00 apiece at the very lowest estimate. They were wiped out in three years and the whole orchard wiped away. That is what the San Jose Scale can do in the South.

Then we have some accurate statistics telling us about the rate of increase of the Scale. The increase of the Scale in Maryland and the Southern States is 300,000,000 from one in a year; let us reduce that, because we are further to the North, and say it is annually increased half of that number, 150,000,000 from one in Ontario, is that not enough? Is not 150 millions from one insect enough of an increase in a year? Then they say it is not likely to come up here in the North and do harm. The plague of London is the same black plague of Asia, but it spread up into England and in 1665 wiped out the greater part of the population of London. We know the San Jose Scale is a bad enemy and we do not want to play with it.

We have got it now measureably under control and we should let the Ontario Government go on doing what they have done, and as I say, every member of this Society ought to back them up in doing it. The Ontario Government has certainly been a benefit to the whole country in this matter, not only to Ontario but the whole country, and I say we should back them up and say that we appreciate the great efforts they have made and I do hope Mr. Dryden may long be the Minister of Agriculture to carry on the administration of the department. I am not a politician. I am a Government servant. I never cast a vote and as long as that is the case never mean to. I do not care whether a man is a Liberal or a Conservative. It is nothing to me; but I say here is a man who is a good servant doing good work for the country and work that has been done in the best way, and to stop or hesitate now is bad for the country. What are we going to do in the future? I say let us help him. We have with us to-day Professor Webster: we have known him for a great many years; one of the first economic entomologists in the world; one of the first in America and that means the world, because with the exception of Miss Ormerod they hardly know what economic entomology is on the other side of the water. Mr. Webster is a man that would tell the President of the United States:—"You are wrong," just the same as he would me or any other insignificant person, if he thought so. We have him here and if he advises us as to the best treatment, let us listen to him. Experience has taught us, there are two good things—treatment with hydrocyanic acid gas and spraying with kerosene. These are so difficult to use safely that people won't, I feel sure, take the necessary trouble. In the whale oil soap we have a remedy easy to use, not very expensive, but a little more expense than our fruit growers will go to after the first year. They are not going to pay the price of even three cents a pound for the amount which will be necessary to control the pest after the first year.

Mr. Dearness :—You can get it for two cents a pound now.

Dr. Fletcher :—They won't go to the expense of two cents a pound for it. It takes a good many pounds to go over an orchard and after the first year I don't think we can trust our fruit-growers to do that work. This is no experiment. Many things *can* be done that are not, if they cost money and trouble, it is the same with the hydrocyanic acid gas. If Prof. Webster was going to fumigate trees, I would say he can kill every Scale, but an ordinary man will not do it. We have to deal with the actual defects which commonly occur in mankind. The thing is practicable if carried out properly and the man who makes the statement that it cannot be carried out is not a practical adviser. If we can teach the fruit-growers of this country that it does pay them and can persuade them, well and good, but I doubt it. For ten years I have been working on this kind of work and I know only too well there is a great deal of difficulty in persuading people to do even what will save them money, when you go to the orchards and houses of fruit-growers and see the way they do this work of fighting insects. I was in the fruit house of a fruit-grower whom I persuaded to buy a pump, and I said " Where is your pump, why don't you use it? " He said, " We did not use it this year, there is no crop." Another man wrote to me from British Columbia showing great interest in spraying. " What is the best kind of pump? I want to get nothing but the best," etc., etc. I was in his orchard this summer and asked him about the pump. He said, "I have not unpacked it, I have been too busy." He imported it from here, got it out there and then had not time even to cut the string that tied the handle on to the pump!

I approve most heartily of the measures adopted to wipe out the San Jose Scale by the Provincial Government and I shall help them in any way in my power. Of course, politics are a very different thing from entomology. As an entomologist I say the work was well done. I do wish to express my appreciation of the work that has been done by the Government, of Professor James for his activity in the department, and Mr. Fisher in his honest and straight-forward dealing with this question. I said to Mr. Dryden last year, " If Fisher has got to go into an orchard and find the San Jose Scale he will treat his own brother or himself as he would anybody else and will destroy everyone of his own trees if he finds them infested." At first Mr. Fisher was a specialist, now he is an expert both as an entomologist and as an enthusiastic man, and I say to-day is the time for people to acknowledge it for the country should know it. We must recognize this question as one to be fought out It is a serious matter and we have not got to the bottom of it yet. Let us have every suggestion that will help us.

The Chairman :—I think we should not undervalue the force of example. There is a place called Abbotsford in the Province of Quebec, one of the few places where apples are grown to perfection. There was an intelligent fruit-grower there, Mr. Charles Gibb, who took to spraying his trees, and I know that a few years afterwards there was not a man in that neighborhood who did not spray his trees. Whether they continued to do so I do not know; the example was catching. Would it not be possible for the Government to induce some good man in one district that has been referred to, to spray his trees and to watch the result and see whether his neighbors would not catch the idea from him and follow up his method? Whatever other plan may be taken by the Government it seems to me that the power of example should not be overlooked. We have had a very valuable amount of instruction to-day, and if there is any one else who would like to make any remarks we would be pleased to hear him.

Mr. W. E. Saunders then moved, seconded by Mr. J. Law, that a committee be appointed to draft the resolution asked for by Dr. Fletcher, to consist of Mr. Lyman, Dr. Bethune, Dr. Fletcher, Mr. Balkwill, Mr. Dearness and Mr. W. E. Saunders. and to report at a later session of the meeting.—Carried. The meeting then adjourned.

EVENING MEETING.

A public meeting was held in the hall of the Y. M. C. A. building at 8 o'clock. There were about seventy-five persons present, including the Right Rev. Dr. Baldwin, Bishop of Huron, and many ladies. The proceedings were opened by the Rev. Dr. Bethune, who cordially welcomed those present, and introduced the President, Mr. Henry H. Lyman, of Montreal, who delivered his annual address as follows:

THE PRESIDENT'S ANNUAL ADDRESS.

By Henry H. Lyman, M.A., Montreal.

Ladies and Gentlemen:—It is again my duty as well as privilege to address you at this the thirty-sixth annual meeting of our Society, and to congratulate you upon the continued success of its work and the high standing maintained by its monthly journal. At our last annual meeting it was a matter of regret that so few members from headquarters were able to attend, but it was a great treat to the members of our Montreal Branch to have the meeting held in that city, in connection with the celebration of the twenty-fith anniversary of the formation of the branch, as it was the first opportunity that our members had had of attending an annual meeting of the parent society since 1882, the only other occasion when the annual meeting was held in Montreal.

In beginning my address last year I dwelt upon the difficulty experienced by an amateur entomologist in composing an annual address, but if I was in difficulties last year, I am in much greater straits now, as not thinking of a second term in the presidential chair, and following the scriptural injunction to "let the morrow take thought for the things of itself," I not only put into that address almost everything I could at the time think of, but also all the items of interest that I could beg or borrow of my friends, and now find myself somewhat in the position of a clock which having struck twelve has to come down to striking one.

Last year I had, shall I say, the temerity to lay before the meeting a great many suggestions, the adoption of which would, I ventured to think, be of material benefit to those engaged in the prosecution of studies in this science, but I am not aware that the slightest movement has been made towards the adoption of any one of them.

I hope that it was not a case of a fool rushing in where angels, if there are any entomological angels, fear to tread, and shall, in order to save my amour propre, at least try to believe that it is only another instance, of which there have been so many in the history of the world, of a reformer being in advance of his time. But while the non-success of my suggestions last year should, perhaps, be a warning to me to leave the making of suggestions to more influential persons, I cannot refrain from re-iterating the opinion that a well-organized Entomologists' Union, on similar lines to those on which the Ornithologists' Union is carried on, could be made of very great benefit to the science of entomology.

Last year I ventured to point out a number of matters which such a union could deal with to advantage but many more could easily be suggested. I recently had an example of the necessity for such an organization for the settlement of matters of nomenclature. A gentleman friend, not a naturalist, but only one who takes a sympathetic interest in such studies, invited me into his office and proceeded to describe enthusiastically the beautiful chrysalis of our milkweed butterfly which he had been shown by a gardener who had found it, and when I said I knew it well, he rashly asked me its name. Immediately I was in a quandary, should I give him only one name, choosing maybe that which I might myself prefer, or should I risk his mental equipoise by plunging him without preliminary training into the vortex of the battle of the synonyms? After a moment's hesitation I decided upon a compromise giving him his choice of three names, writing down, lest even these should be too great a strain upon his memory, that

it used to be called Danais Archippus, but that many authorities now hold that it should be called Danais Plexippus, while Dr. Scudder calls it Anosia Plexippus, and as they say, I let it go at that.

Last year I suggested, as one of the things which such a union could deal with, the question of a uniform standard method of pinning and spreading specimens, but there is another point in this connection upon which a recommendation might be of some service, and that is in regard to setting a fair number of specimens to show the under side. Nothing has caused me greater surprise than finding large and important collections of butterflies without a single underside showing. I defy anyone to separate the North American species of Argynnis, Colias, Grapta, and a number of other genera from a study of the upper sides only, and when I am shown ten or a dozen cabinet drawers filled with specimens of Argynnis with not an underside among them, the effect is simply maddening, and I am sure that an attempt to study this group under such circumstances would speedily reduce me to a state of utter imbecility. In the magnificent work of Mr. Wm. H. Edwards the undersides of the species treated of are invariably shown, and why they should be excluded from the cabinet I cannot conceive. The failure to show the undersides of the species not only renders the study of types much more difficult but also greatly endangers the types as it becomes necessary to remove the glass covers of the drawers and handle the specimens in order to see the undersides.

Another point which could with great advantage be decided by such an authority is the nomenclature of the larval rings. Considerable diversity has existed upon this subject, some authors counting only twelve segments, excluding the head, while others, and doubtless the majority of recent years, have, possibly to show their superiority to antiquated superstition, made the number thirteen by counting the head as number one. But one is still frequently in doubt as to which method an author follows until one has made a careful study of the description. Would it not be better to discard both these systems and follow that adopted by Dr. Scudder, and divide the larva into head, 1st, 2nd and 3rd thoracic, and nine abdominal segments? Under such a system there could be no possibility of any misunderstanding.

Last year I ventured to assert that we should never have a natural and therefore scientific and satisfactory classification of the Lepidoptera until we know them in all their stages, and if this is admitted, the importance of working out the life histories becomes immediately apparent. An encouraging amount of this work is now being carried on though very much less than might and should be done. The reasons for the paucity of this work are not very far to seek. In the first place there are not half enough entomologists, and those that we have are generally overworked. The amateurs, like myself, are generally only able to snatch a half hour or so at a time from their regular occupations to do such work as describing preparatory stages, which can only be done satisfactorily by daylight, while many who are much less favourably situated cannot even do that. Many, unfortunately, care only for accumulating a collection of imagos, and in the case of these we can only hope that they will grow from mere collectors into true entomologists, but probably the chief reason why more do not take up this interesting and important work is its inherent difficulty. With many species it is easy enough to secure eggs and to rear the species through all their stages, but to make descriptions of those stages which shall be of any use to a specialist is generally speaking a very difficult matter unless one has had very special training. This is, of course, largely due to the great advance of our knowledge, the requirements of which have become continually more exacting. The older authors, those who have been called the fathers of entomology, were certainly more comfortably off in this respect, as it seems to have been considered sufficient to give such descriptions as the following: "Senta Ulvæ; Larva, yellowish ochreous, with several fine lines. In reed (Arundo Phragmites) September, March, April," or "Xanthia Aurago; larva grey, with oblique darker streaks, on beech in May."

Nowadays such descriptions would not do as we are expected to note and describe everything, down to the minutest detail. We must begin with the egg-laying by the parent and go through all the stages to the imago.

Many hints and directions for the uniform description of larvæ have been published from time to time. Such a paper from the pen of Dr. William Saunders appeared in the second volume of the "Canadian Entomologist," and our society published forms for this purpose, but for some reason, possibly from their not being listed with the other entomological supplies, they were not much used. But these hints and directions, though excellent, are hardly up to present requirements.

The following are the directions of Dr. H. Guard Knaggs in his Lepidopterist's Guide for the young, not the veteran, collector.

"In carrying out observations upon the egg state, the student should note :—

How the egg is laid : Whether unattached or attached ; or if so, by what means, and also by what part of its surface ; the position of the female (and of her abdomen) at the time of laying—whether hovering, at rest, or in what other act ; whether the eggs are laid singly or in batches, and, if so, in what number, and whether unarranged or how arranged ; also the total number deposited and whether nude or covered, and, in the latter case, how covered or protected, together with any exceptions, individual, special, natural or abnormal.

When laid : At what date or dates, at what time or times of day or night ; at what intervals, how long after copulation and how long after emergence of the female.

Where laid : If not on the food plant, where ; if on the food, the exact position.

The duration of the egg state, in species and in individual cases ; influences of temperature, soil, locality, altitude, timé of year, etc., which promote, retard or modify the natural changes.

The appearance of the egg itself, as to form, colour, or colours, markings, elevations, depressions, and sculpture on the surface ; together with changes, normal as well as irregular, from the time of exclusion to that of hatching.

The mode of exit of the larva should be exactly observed and any other remarks or experiments which may present themselves to the student, should if possible, be followed up ; such as, for instance, those of proving how long the egg state may continue (i.e., the ovum retain its vitality) with a view to throwing light upon the, at present, hidden causes of the disappearance and periodical re-appearance of certain species ; and of discovering if there be any sexual arrangement of the eggs, as laid, to account for the emergence of a preponderance of one sex of the future moth at one time, of the other at another, from the same batch of eggs.

In describing, the best order will be to give the names of the parent species, and then, by the assistance of microscopical examination, in their order, the measurement, form, sculpture, colour, markings and changes ; the arrangement of the eggs, time, situation, etc., after which a diagnosis from the allied species may be added, as well as any further remarks which may suggest themselves."

So far Dr. Knaggs, and when we have got that far, mind you, we have only got these little creatures out of their eggs, and I might go on at great length giving the directions for observing and describing the caterpillars, but I spare you. Let it suffice to say that we are urged to carry out the observation and description of all the succeeding stages, with the same care and attention to all the possible and impossible minutiæ ; but surely this is a "counsel of perfection" unattainable by ordinary mortals, and especially by busy men.

But even taking a much lower view, the standard expected is still high. We have before us a little creature, perhaps barely a tenth of an inch long, divided into a head and twelve other segments, upon each of which there are various appendages, and we are expected to describe all these things correctly in spite of the fact that the owner of the appendages is constantly crawling out of focus, and perhaps after all our trouble, when we think that we have drawn up a fairly correct description and venture to publish it, some subsequent observer, in a "criticism of previous descriptions," perchance accuses us of having put some appendage upon the wrong segment. Of course, when we have

abundant material we can kill a specimen or two occasionally in the cyanide jar and then describe them at our leisure, but often we cannot spare any for this purpose, especially in the case of species which are difficult to rear.

Occasionally we come across a species, the larva of which is easy to describe, but as a rule it is very difficult to make a satisfactory description. The markings are often puzzling and the colours are frequently indescribable, it being almost impossible to give them names. This chiefly arises from the more or less translucent nature of their bodies and from the way one shade melts, as it were, into another. In many cases in which there is not much change after the first moult, we still notice, as the larva grows, certain things which we had not noticed in the earlier stages, and then we are haunted by a horrible uncertainty as to whether these points have really developed in the later stages, or were only overlooked when the creature was much smaller.

But, doubtless, the chief difficulty in the way of the general preparation of useful descriptions of preparatory stages is that probably at least nineteen men out of twenty do not know what are the chief points to be observed and described, and hence we find some men describing, with conscientious and laborious exactness, organs or appendages which are common to at least all the larvæ of the particular group to which the subject of their observations belong, or on the other hand, contenting themselves with making the slightly vague statement that there are "a number of warts with radiating bristles on each segment."

To overcome these difficulties and to bring the work of as many observers as possible into harmony, it seems to me that we require a simple but comprehensive "Manual" for the study of preparatory stages which, while avoiding diffuseness and unnecessary technicalities, should still be precise and explicit, taking only the most elementary knowledge for granted, and as fully illustrated as possible; not only showing a figure of a typical caterpillar, but having outline figures of all types of larvæ, showing how organs and appendages are modified and how they can be homologized, and with the fullest particulars of the important points to be observed in each type of larva, and with typical descriptions drawn up from common and well-known larvæ as models.

After a careful study of such a work with as many specimens as we could conveniently lay our hands on, we would be in a position to make thoroughly useful descriptions because knowing what we should look for, we would not overlook important points, but would find them, if present. But I shall probably be asked who is the man for this task, and in reply would say that, in my humble opinion, Dr. Harrison G. Dyar, who has made such extensive studies upon many different groups of larvæ, is well qualified to undertake it, and it could probably be issued as an official bulletin by the Department of Agriculture at Washington.

Another work which is also much needed is a supplement to the "Bibliographical Catalogue of the Described Transformations of North American Lepidoptera," prepared by the late Henry Edwards, and issued as Bulletin No. 35 of the United States National Museum in 1889; or what would be still better, a revised edition brought up to date of the same work. Such a work is most important in order that people may be informed as to what work has already been done, and what is lacking to fill up gaps.

I have said that a knowledge of the preparatory stages is necessary for a satisfactory classification of species, but I believe it to be also necessary in some cases even for the discrimination of species. An extremely interesting case of this kind is that of the two forms, or as I believe them to be, the two species of Halisidota, viz. Tessellata, A and S., and Harrisii, Walsh. You are doubtless aware that as long ago as 1864 the late Benjamin D. Walsh called attention to the fact that there were two kinds of larvæ of Halisidota producing imagos which were indistinguishable, one being the species named Phalæna Tessellaris, by Abbott & Smith, but now known as Halisidota Tessellata; and the other an undescribed form or species which he named Halisidota Harrisii. These two forms of larvæ differ remarkably, and would never be taken for anything but species of the same genus. The larva of Tessellata, as you know, varies remarkably, but only within well-known limits. The body is usually black or blackish; the head generally black, but

occasionally tinged with reddish brown, the feet black, the prolegs blackish, the hairs cinereous, blackish on the dorsal ridge, or a yellowish-brown with darker ridge. Occasionally one is found when about half grown of a gamboge yellow, with a tinge of pink in it, but these change before maturity to one of the usual types. The principal appendages are four pencils of black hairs, with white pencils below them on the thoracic segments, two each on the second and third thoracic segments, and two black pencils on the eighth abdominal segment. There is also a lateral white pencil on each side of the second thoracic segment and some long hairs on the ninth abdominal one. In Harrisii, on the contrary, the body and hairs are milk-white up to the last moult, the mature larva being of a rather dingy brownish-yellowish shade, slightly darker on dorsal ridge. The head is yellowish-brown, while the pencils, which are black in Tessellata, are orange in Harrisii, except that there are no orange pencils on the posterior part of the body, but only two whitish ones projecting backwards on the eighth abdominal segment. The feet are yellowish, tipped with reddish-brown, and the claspers whitish. Thirty-five years have now elapsed, and yet the question as to whether these are distinct species or only interesting varieties has not been definitely and satisfactorily settled, a fact by no means creditable to North American lepidopterists.

Some years ago I became interested in this question, and with a view to making experiments imported and set out in our Mount Royal Park in Montreal a plane tree (Platanus Occidentalis). It has now grown to be a fair-sized tree about 25 feet high, and last year I began my experiments by securing the eggs of Tessellata. These in due time hatched and were divided between several glass breeding jars, in one of which I had leaves from my plane tree, and in the others oak, bass and other trees. I had no difficulty except with those on the plane, but they refused to eat. Fearing they would starve immediately I gave them an oak leaf for a start, and after they had had a meal or two took it away and left them only the plane. This hunger forced them to partake of sparingly, but they did not relish it, and the mortality was heavy. A number passed first moult, but I only succeeded in carrying two past the second, after which they died.

This year I appealed to Dr. Dyar to try to get me specimens of H. Harrisii, and he and his assistant very kindly devoted part of a day to looking for them, but they were only successful in finding four. These were sent me, but naturally I was not able to make many experiments, and only found that while they preferred plane they would still eat bass and elm. The larvæ, are however, so very distinct from Tessellata that it seems probable that the species is distinct in spite of the imagos being indistinguishable. I would be inclined to lay down a law that where any two forms are certainly distinguishable in any of their stages, and where the two forms are never found to breed, the one from the other, or to occur in the same brood, they are entitled to rank as distinct species.

The truth in regard to these particular forms ought to be easily investigated in any locality where Harrisii occurs in moderate abundance. All that is necessary is to secure a fair number of larvæ, and when the moths are disclosed from the resulting cocoons to mate them and then secure as many eggs as possible, preserving the parent moths and keeping the batches of eggs separate. If under these circumstances the larvæ were all of the Harrisii type it would be fair to conclude that the form is a good species, though it would be all the better if a further experiment were tried, viz., to see if Tessellata and Harrisii would mate and produce fertile offspring with characteristics of both forms in the preparatory stages.

I have thus attempted to show the importance not only of the study of preparatory stages, but also of experimentation therewith, but there are many other and more practical subjects for study and experimentation than those to which I have alluded, such as the possibility of propagating and disseminating bacterial diseases among caterpillars as a means of checking the ravages of injurious species, and this leads me to direct attention to the utter lack of all provision of facilities for the carrying on of such work at the Central Experimental Farm.

Last year I referred to the excellent work being done by our Dominion Entomolo,gist Dr. Fletcher, but he is greatly handicapped by the lack of almost every requisite for the efficient prosecution of his work. It is true that since our meeting last year he has been given another assistant in the person of Mr. Arthur Gibson, a director of this Society, but much more than this is needed, and the farm should be equipped with an insectary of the most approved design. and also, I would suggest, with a small cold storage chamber for the successful wintering of pupæ and hibernating larvæ, which might be the subjects of experimentation. There are many such insectaries in the United States, and it is high time that we had at least one in Canada, especially as no great outlay would be necessary, and I would respectfully represent to "the powers that be" that there is no economy in employing a first class entomologist and not giving him every facility for doing the very best work of which he is capable.

But I must pass on to other subjects, and would invite your attention to a rapid review of some of the more important work being carried on by leading workers in this branch of science.

In Canada, owing to the opposition to the working of the San José Scale law in Ontario, a commission was appointed to inquire as to the extent of infestation, whether it had spread beyond its former limits, whether the destruction of infested trees would check the further spread of the scale, whether it would be possible to exterminate it, whether there was danger of further infestation from scales being carried across the Niagara River, whether opposition to the act was unanimous, how the work of inspection had been performed, the commissioners being invited to make any suggestions they thought desirable as to changes in the mode of procedure, and as to measures for the complete suppression of the pest. The commissioners appointed were Dr. James Mills, President of the Agricultural College at Guelph, chairman, with Mr. John Dearness, ex-President of this Society, and Mr. W. H. Bunting, of St. Catharines. The inquiry was opened on 20th June and closed on 14th July, the Commissioners visiting the counties of Lincoln, Welland, Wentworth, Elgin, Kent and Essex in Ontario, as well as the New York side of the Niagara River and Catawba Island in Ohio, and examining one hundred and sixty-eight witnesses. In regard to the amount of infestation and the extent to which it had been controlled, it was found that the greatest infestation is in one corner of Niagara Township, near Niagara on-the-Lake, and in the Township of Harwich, Kent County, in the neighborhood of Guild's Post-office. There is a limited infestation at Kingsville, and less important ones at St. Catharines, Winona, Burlington and near Chatham. In ninety-one other cases trees planted within the last two years were found infested. These trees were all destroyed, and this year's inspection failed to discover scale in any but thirteen out of the ninety-one places. The scale was found in five nurseries, but the infested stock was destroyed. While the areas of infestation are not large the inspector estimated that it would be necessary to destroy over 150,000 trees to be reasonably sure of exterminating the scale. The inspector thinks that the scale can be exterminated by the prompt and vigorous enforcement of the Act, but the Commissioners incline to the opposite opinion, and they also believe that the damage which the insect is capable of doing in this latitude has been overestimated. They found that, as was to be expected, the owners of orchards were not unanimous in opposition to the Act, for while those whose orchards are not in immediate danger are overwhelmingly in favor of it, those whose orchards are infested or in immediate danger of becoming so oppose it, largely on account of the inadequate compensation allowed for trees which are destroyed, but also because no effort was made to save valuable trees which were only slightly affected, and because the owners had no voice in the determination of the value of the trees destroyed. The Commissioners, while acknowledging the faithful work of the inspector and his assistants, thought that more consideration might have been shown for the feelings of the owners of infested trees and a less offensive method of marking such trees adopted. They advised a continuance of the inspection on modified lines for some time to come but that valuable trees be treated for the purpose of destroying the scale without cutting them down and that owners of trees not so badly infested be required to treat them by a prescribed method once a week from the time of notice till the 15th

October. They also recommended that the compensation for trees destroyed be increased, the owner being allowed twenty-five per cent. of the value including the crop and that he be represented in some way at the valuation. They also recommended that the utmost care be taken to prevent the spread of the scale and that a circular of instructions be prepared and sent to every orchardist in the infested areas and that every owner of an orchard in the Province be encouraged to make a careful inspection of his orchard next winter to discover whether or not there is any San José Scale in it.

In the United States the work in connection with the San José Scale has been largely carried on by the Agricultural Experiment Stations, but the proposed law governing interstate commerce in nursery stock failed to pass the American Congress. An important series of investigations, however, was carried out last autumn at Washington for the purpose of determining whether it is possible for the scale to remain alive upon any fruit dried by any of the methods in use in the United States. This work was aimed especially at the German regulations prohibiting the introduction of American dried fruit into that country. The results of that work as published in Bulletin No. 18, New Series, were very satisfactory as it was fully established that any one of the commercial drying processes is absolute death to the scale insect.

Mr. Marlatt has undertaken a systematic study of the armoured scales (Diaspinæ) and has cleared up many doubtful points of synonymy, the most interesting point, perhaps, which he has brought out being the occurrence of the European Aspidiotus Ostreæformis in the United States where it has existed unrecognized for several years, although late correspondence shows that it is already distributed from New York to the Mississippi River and even to Idaho.

Dr. Howard has had a careful study of the insects injurious to the forest trees of the extreme north-western states carried on by Dr. A. D. Hopkins who was employed as a temporary field agent for that purpose. He made a careful study of forest conditions in Northern California, Oregon, Washington and Idaho and found very many new Scolytidæ and has been able to make practical suggestions which will be of value to the lumbermen in that region. This work should also be of value to our lumbermen in British Columbia and the information obtained should certainly be made available to them.

Further work on the study of insects liable to be introduced from abroad has been carried on by Dr. Howard and his assistants. One of the latter was sent to Porto Rico in the spring and made large collections of the injurious insects of that island and further observations are being made. Dr. Howard has been accumulating a large collection of injurious insects of first-class importance from different parts of the world, especially Australia, Japan, Mauritius and Reunion, while the collection of European injurious insects has been greatly added to. The importance of this line of work was strikingly illustrated in an instance which occured in the spring of this year, when an insect boring in the stems of orange received in California from Japan was at once recognized by a comparison with the specimen received some time ago from that country, the habits of which had been previously reported upon.

Late advices show that the importation of Novius Cardinalis into Portugal, which were sent by the Washington office through the courtesy of the State Board of Horticulture of California, was fully as successful as anticipated and all danger from Icerya in the extensive orange groves along the River Tagus is now considered a thing of the past.

Mr. Chittenden has been working mainly on garden and orchard insects and has published his results in Bulletin No 19, New Series, a pamphlet of 99 pages replete with most interesting information.

The usual Western field work on injurious grasshoppers has been carried on and it is claimed that Mr. Hunter, the temporary field agent, has set at rest all rumors in regard to the Turtle Mountains region in North Dakota and Manitoba as a possible permanent breeding ground of Melanoplus Spretus, and it is charged that the occasional swarms which have settled in Dakota and Minnesota have come from the region of the Assiniboine River.

Dr. Howard has published in the year book of the U.S. Department of Agriculture for the year 1898 an important paper on the insects affecting the tobacco plant, which is admirably illustrated by a new series of cuts, and three new pests are treated of But by far the most interesting and important work which has been recently accomplished by Dr. Howard and his assistants is the successful introduction into California of the insect named Blastophaga Grossorum.

Hitherto it has been found impossible to grow in that state any figs which would compare with the Smyrna fig of commerce, which is grown about the eastern end of the Mediterranean Sea. The Smyrna fig tree had been started in California but the flowers were sterile and the figs invariably dropped to the ground before attaining the size of much more than three-quarters of an inch in diameter, but in its native home the flowers are fertilized by this minute insect know as Blastophaga Grossorum, which normally inhabits the flowers of the wild fig commonly known as the caprifig. These figs growing on the mountain side are broken off by the inhabitants and are tied to the branches of the Smyrna figs at the proper season of the year. The insects issuing from the caprifigs and covered with pollen crawl into the Smyrna figs, pollenizing the flowers and bringing about the ripening of the fruit and the production of the seeds upon which the flavour of the Smyrna fig largely depends, and it was decided that the only way in which a fig equal in quality to the Smyrna fig could be grown in California was to introduce the Blastophaga into that state. Private attempts to do this failed and the government was appealed to for aid, and Dr. Howard, after laying the matter before the Secretary of Agriculture, was authorized to make the attempt and succeeding in introducing living specimens of these useful little insects among the Smyrna figs and caprifigs of Fresno, California. The introduction in 1898 was unsuccessful, but this year success crowned the efforts and not only have two generations of the insects developed but many Smyrna figs have been successfully fertilized.

Work is being continued by the Washington Staff on the study on the geographical distribution of injurious insects ; the bibliographical work also continues and it is intended to publish another supplement to the Bibliography of Economic Entomology bringing the list down to January 1900.

That the importance of entomology continues to attract increased attention is shown by the appointment of a state entomologist for Texas. The lamented death of Mr. H. G. Hubbard early in the year interrupted the completion of his elaborate work on insects affecting the citrus trees, and caused a great loss to American entomology. He was an able entomologist, a wonderfully good collector and a truly lovable man.

Last year I had the pleasure of announcing the approaching publication of Dr. W. J. Holland's Butterfly Book. Shortly after our meeting this work was issued and received a hearty welcome from the entomological world, and up to 1st of July last upwards of 3500 copies had been sold, which is certainly remarkably encouraging. Among other important works which have appeared during the year may be mentioned the Monograph of the Species of Acronycta and certain allied general with nine plates of moths, four plates of larvæ and nine plates of structural details, by Drs. John B. Smith and Harrison G. Dyar issued in the proceedings of the United States National Museum, and which is a very important and useful work. About the same time in December last appeared Dr. Henry Skinner's Synonymic Catalogue of the North American Rhopalocera replacing Mr. W. H. Edwards's catalogue of 1884 which had been out of print for some time. This work was much needed and will be of great assistance to lepidopterists. Dr. Dyar's proposed check list to which I referred last year has not yet appeared as the author informs me that he is waiting for Prof. Fernald to complete his revision of the Tortricidæ. Dr. Ottolengui has not yet completed his monograph of the Plusias but expects to issue it during the coming year.

I am glad to say that we are likely soon to have a monograph of the Sesiidæ. The late Henry Edwards who had done much work in this group and had described a very large proportion of the known species contemplated the publication of such a monograph but was not able to do so, but after his lamented death his mantle fell upon Mr. Beuten-

muller who had special facilities for the work in having all Mr. Edwards's types under his care in the American Museum of Natural History, and who has been working upon the group for some years. He has now secured the consent of the Directors of the Museum to the issue of the monograph and it is expected to appear next year. Dr. Packard has been delayed in regard to the publication of the second volume of his monograph of the Bombycine Moths and it will not appear during the coming year. He is waiting to fill up some gaps in the life histories and to obtain good coloured drawings of the larvæ of Platysamia Gloveri, P. Columbia and other forms. The part will include the Ceratocampidæ and Saturniidæ, and any collector who can obtain the eggs or larvæ of P. Columbia would be rendering a service to science by contributing them to aid in the completion of this work. Though not published during the present year attention should be directed to Dr. Packard's Text Book of Entomology, a most important treatise on the anatomy, physiology, embryology, and metamorphoses of insects which has been accorded a very flattering reception not only by the leading entomologists of this continent but also by those of the old world.

Among other publications may be mentioned the pamphlet on the Hessian Fly in the United States prepared by Herbert Osborn and issued as Bulletin No. 16. New Series, of the Division of Entomology at Washington.

Mr. Wm. H. Edwards although retired from active entomological work has not wholly given up his interest in this subject. and recently wrote me that he had urged Mrs. Peart to fill up some of the gaps in his album of drawings of preparatory stages of the butterflies, and said that he wanted to see these drawings deposited in some public institution where they would be available for reference, and it is much to be hoped that this disposition of them will be made. The formation of an Entomological Society in the Canadian North-West Territories is an event of which we should all be glad. It is much to be hoped that the interest which the energetic President has awakened will continue and increase and bear good fruit, and that the Society may become affiliated with us as a branch, and this leads me to the suggestion that it would be an excellent thing if there were more co-operation among the branches of the Society. The Montreal Branch suggested that an interchange of all the more important papers read before the various branches would enable all the members to have the benefit. This suggestion was warmly received by the Toronto Branch, and a few papers were sent up from Montreal, and although the idea has not proved as fruitful as we hoped it would, better results may be, and I trust will be, achieved in the future.

One other event of the past season to which I should refer, was the advent through the medium of the daily press, of a terrible bogey in the form of a bloodthirsty insect which was "written up" by the knights of the quill under the name of the Kissing Bug. It was said that its scientific name was Melanolestes Picipes, and the wildest stories were told of its deadly ravages. Illustrations of it were published, and various kinds of insects of different orders were exhibited in newspapers' windows as genuine specimens of the bug. Quite a number of deaths were attributed to it, and many timid people, especially women, were seriously alarmed. It started from Washington (there is something very suspicious about this, but perhaps our friends of the Division of Entomology can establish an alibi) and spread all over the continent, creating devastation everywhere with the exception it is said, of Baltimore, whose newspaper men are reported to have been too conscientious to write it up, though the latter statement seems almost more incredible than the stories told of the bug. At last the secret was given away and the kissing bug pronounced a myth, the story having been started as a hot weather silly season hoax.

I have again to acknowledge my indebtedness to Dr. Howard for his kindness in favoring me with much interesting information and valuable suggestions which have been of much service to me in the preparations of this address. And now in laying down the office with which you have honored me, and retiring to the comfortable dignity of a Past President, I desire to thank you most heartily for the honor you have done me in electing me to the highest office in your gift, and especially are my thanks due

to the other officers of the Society for their unfailing courtesy and their readiness to afford me every assistance in their power, and to you, ladies and gentlemen, who are not entomologists, I would say that if you have been dreadfully bored by my address you must pour out the vials of your wrath upon the heads of the Council who arranged that it should be delivered at this meeting instead of being read in the sanctity of the Society's own room.

The Rev. Dr. Fyles expressed the thanks of the meeting to the President for his interesting and valuable address. In the course of a humorous speech, which was much enjoyed by the audience, he stated that when it is borne in mind that at least one-tenth of the vegetable products of the country are annually destroyed by insects, the study of their habits and of the best means of dealing with them is of manifest importance.

Dr. Fletcher gave an address illustrated with lantern pictures, on "Some Interesting Insects." He prefaced his remarks by referring to the statement of the previous speaker regarding the loss caused by insects and said that if there was even a chance of saving some of this ten per cent. loss the study of entomology must be of great economic importance. He considered that a great deal of the destruction of food products by insects is preventable and that entomologists were doing a most valuable work in instructing the community as to what measures were the best to be taken for the purpose. He spoke also of the many points in the life-histories of common insects that still require to be investigated, and of our want of knowledge of the manner in which they lived through the winter. Here was a field that would afford ample employment to every entomologist. Beautiful illustrations of the following and several other insects were thrown upon the screen and their peculiarities or points of interest described by the speaker: The Gipsy Moth (*Ocneria dispar*) which derives its specific name "Dispar" from the great disparity in the sizes of the male and female moth, the latter being nearly double the size of her mate. The state of Massachusetts has been engaged for the last nine years in trying to exterminate this insect and has spent close upon a million dollars in the effort. While the object in view has not been completely accomplished, the insect has been prevented from spreading over the surrounding country and is confined to an area that is gradually becoming more restricted.

The Brown-tail Moth (*Euproctis chrysorrhea*, Linn.) is another importation from Europe in the state of Massachusetts which is proving very destructive. Active measures however are being employed for its extermination in a similar manner to the preceding species.

The Mediterranean Flour-Moth (*Ephestia Kuhniella* Zell) Fig. 1., which has also come to us from Europe, has been found in several mills in Ontario and various parts of the

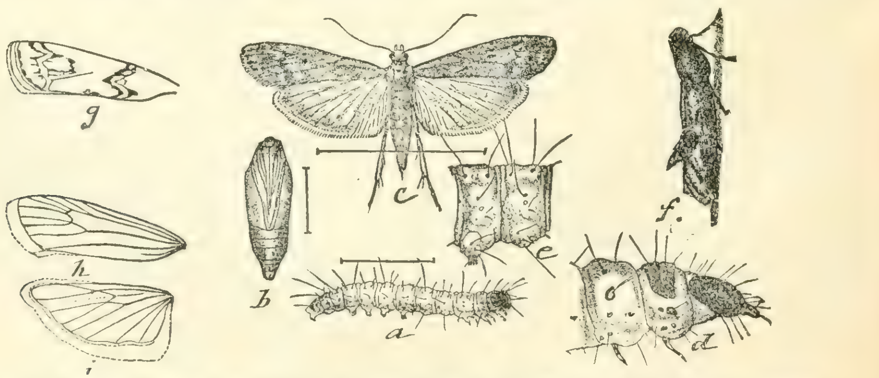

Fig. 1. The Mediterranean Flour-Moth; *a* Caterpillar; *b* Chrysalis; *c* Moth, slightly enlarged; *d* and *e* enlarged details of Caterpillar; *f* side view of Moth; *g* markings on forewing; *h* and *i* venation of wings.

United States. It is a serious pest, as the larva clogs up the bolting cloths with its webs and prevents the flour from sifting through. The moth itself does no damage.

Fig 2. Chinch-bug magnified; the hair line below shows natural size.

The Chinch-bug (*Blissus leucopterus*) Fig. 2, caused a loss in the State of Illinois alone of seventy-three millions of dollars in a single year by its destruction of corn and wheat crops. It is now controlled to a large extent by means of a fungous disease which is disseminated by distributing affected individuals wherever the bug is numerous. Fortunately for us this insect is rarely found in Canada and has never done any harm to our crops.

Fig. 3. Hessian Fly greatly magnified.

The Hessian Fly (*Cecidomyia destructor*, Say) Fig. 3, is doing considerable damage in the wheat fields of Ontario to-day. In some parts of Manitoba it is also doing great injury, destroying from five to twenty per cent. of the crop. There it has only one brood in the year, but here and further south there are two.

Fig. 4. Polyphemus Moth, female, natural size.

The Polyphemus Moth (*Telea polyphemus* Linn) Fig. 4, a very handsome insect, whose larva feeds largely upon elm. The caterpillar eats out a large portion from one side of a leaf, and, when resting, fills the space with its body. The colour matching that of the leaf, and the serrated outline of the creature's back corresponding closely to the original leaf, afford it a remarkable protection against ordinary enemies.

Fig. 5. Polyphemus Caterpillar.

Fig. 6.] Sphinx drupiferarum, natural size.

The Plum Sphinx (*Sphinx drupiferarum*, Sm.-Abb.) Fig. 6, whose larva is furnished with a stiff bristly tail, erroneously supposed by ignorant people to be a poisonous sting.

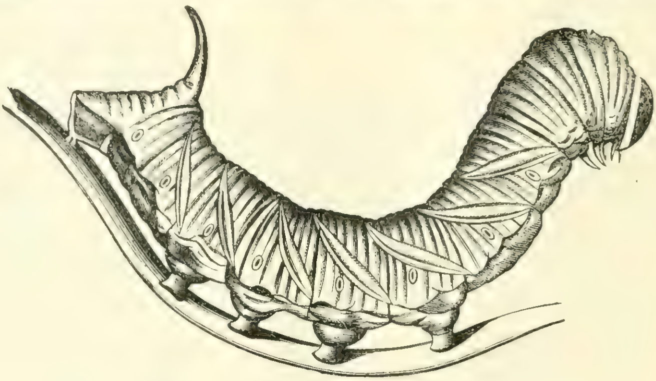

Fig. 7. Sphinx drupiferarum larva.

The Yellow-necked Apple tree Caterpillar (*Datana ministra*, Drury) and several other interesting species of insects were next exhibited and briefly described. The closing picture displayed the extraordinary chrysalis of an African butterfly which bears a striking resemblance to the face of a monkey. The lecturer regretted that he was unable to obtain an illustration for the lantern of a similarly grotesque chrysalis found in this country, that of the well known butterfly *Feniseca Tarquinius*, Fabr., whose larva feeds upon the woolly aphis of the alder.

The following paper was then read by Professor Webster :

ONE HUNDRED YEARS OF AMERICAN ENTOMOLOGY.

By F. M. Webster, Wooster, Ohio.

This is an appropriate year for retrospections ; and why not in the science of entomology as well as elsewhere? Why may we not stand on the threshold of a new century as the footman who has made his way over the snow-clad prairies, and, at setting sun, faces about and follows with his eyes the stippled, undulating line of tracks that marks his wanderings over the plain of glistening white? Mayhap, as the wanderer turns again to resume his journey, it will be with renewed vigor and encouragement that will support him in his onward course. And yet the illustration is, in some respects, inapplicable to the case in point, as the entomology of 1899 contains not only all of the knowledge

that is being accumulated in regard to the science at the present time, but all that has come down to us through the past. The results of a piece of entomological work, carried out at the present time, represent not only what the present author has himself accomplished, but the best that has gone before, precisely as the four monster battleships, two Russian and two American, now in course of construction in the Cramp shipyards at Philadelphia, represent not only the triumphs of modern ship building, but the lessons taught by the failures and successes of hundreds of years of ship building. As entomologists we are now working, not alone with our own light, but with our own plus that of all that has been done before us, or so much thereof as has not been eliminated by the siftings of time as the dross is eliminated from the pure metal by the crucible. But for the labors of those who have gone before us, crude though such may now appear, the present status of the science could not now be possible. He that does his best in his day and generation will have little to regret thereafter.

Going back to the beginning of the present century, we find the science of entomology but little more than in embryo; even in England and Europe, it was still in a very primitive state as compared to the present. Up to about 1775, all information relative to American insects was only obtainable by collections being made in this country, and sent over to England, France or Germany, for determination and description. Thus it came about that original descriptions of many of our species of insects, especially the more common ones, are to be found in foreign publications, and the types of these species are scattered through the collections and museums of England and Europe. In fact, during the latter half of the last century and the beginning of the present, this was the only course possible to pursue, as there were no collections or libraries in this country, and the educational institutions were exclusively classical in their nature. Even so late as 1815, Harvard offered no direct instruction in natural history, except in the lectures of Prof. Peck, and for these an extra fee was charged, while, when Thomas Say went to the Philadelphia Academy of Science, in 1812, he found a company of men had founded it with a view to anything but the advancement of science, and the collections consisted of some half dozen specimens of common insects, a few madrepores and shells, a dried toad and a stuffed monkey. But the facilities for securing entomological material from this country, by foreign entomologists, must have been exceedingly slow and unsatisfactory. A few specimens brought home by a returning traveller, or secured through the hands of captains of ships or from army officers, were probably the channels through which the major portion of the material was obtained. Even the American post was slow and expensive, and it was often necessary for entomologists to wait for months until some friend happened to be going in the right direction, and could be prevailed upon to carry letter and specimens to a fellow worker, The correspondence of all of the early workers in entomology indicates very clearly, how much they were hampered by these deficient methods of communication. Even so late as 1831, Dr. T. W. Harris wrote as follows, in some remarks appended to his catalogue of the insects of Massachusetts: "Should any young sons of New England have the inclination to turn their attention to this interesting branch of natural history they must for want of necessary books on the subject remain in ignorance of the labors of their European contemporaries; and although they may have discovered many curious and valuable facts respecting our insects, they must resign to foreigners the honor of making known the objects of their investigations."

In view of the foregoing, then, it is not surprising that the close of the last century should have found so little accomplished in entomological research in America, and that except for an occasional fragmentary paper published in some local journal, or at best in the transactions of some semi-scientific body, there had been but two contributions to the knowledge of American insects and one of these was published in England, being entitled to consideration here because of its relating wholly to American insects. The first of these was entitled "Natural History of the Slug-worm," a pamphlet printed in Boston in 1790 and written by Professor Peck, and for which the author was awarded a premium of $50.00 and a gold medal by the Massachusetts Agricultural Society. The second was published in England in 1797 and was entitled "The Natural History of the Rarer Lepidopterous insects of Georgia," by J. Abbot and Sir J. E. Smith and comprised two folio volumes with 105 colored plates.

Thus it will be seen that, whatever collections had been made in America, these were in foreign hands, and the descriptions published in foreign literature, and it was under these conditions that the present century found the science of entomology. But, two events had transpired which, though giving no indication of their future effect, were to start the science, both pure and applied, in that forward movement that has resulted in its present condition.

On July 27th, 1787, there was born in Philadelphia, to Benjamin Say and wife, a son, who was afterwards named Thomas. On November 12th, 1795, in Dorchester, Massachusetts, there was born to Thaddeus Mason Harris and wife, a son, who was afterwards named Thaddeus William. The first of these was the son of a Quaker physician and apothecary, and the other the son of a Congregational minister. With these two lads, who at that time gave little indication of their future greatness, and the state of affairs that I have indicated in the foregoing, began what might well be termed the first century of American entomology.

Ere the present century had been ushered in, there had been serious depredations of insects, and now, with the establishment of an agricultural press there came communications and discussions regarding the nature of the insects implicated in these ravages. These contributions came from both the north and the south, and westward from beyond the Allegheny Mountains, but there was none to throw scientific light upon any of the problems involved. No one to identify the species of insects that were engaged in depredations, or to furnish the information that would enable the people to understand their habits, or to determine whether there were one or several kinds engaged in the work of destruction. There was chaos. Who was there that would from out of this bring system and order?

The boy, Thomas Say, had proved an indifferent pupil; had been taken from school and placed in his father's shop; then started in business and ended in bankruptcy. From boyhood he had taken the greatest delight in collecting insects and he now turned his back as it were on business and began the work that was to make his name familiar throughout the world where natural science was studied, and give him the well-earned title of "The Father of American Entomology." About 1817 he began to publish the results of his studies and continued up to the time of his death in 1834. Though his work was incomplete and has been in some cases criticised for its want of accuracy, yet it was the foundation of the technical branch of the science in America.

The boy Thaddeus W. Harris, on the contrary, seems to have been studious but not at all inclined towards natural science. While at Harvard, from 1811 to 1815, he seems to have developed a taste for entomology which appears to have been stimulated by his friend and instructor, Professor Peck. It is interesting to note that his studies, even at an early date, began to take a somewhat different course from those of Thomas Say in that he became interested in the habits of the insects which he studied. He began to collect insects as early as 1820 and, as he tells us, soon became impressed with the great need of a manual of American entomology. This was doubtless the primitive idea that later led up to his work that has become classical, viz., his "Insects Injurious to Vegetation;" published in 1841 and reprinted in 1842, and again in a revised form in 1852. Though this embodied the results of long years of patient labor under the most discouraging circumstances, the author received from the State for his labor the munificent sum of $175.00. This work was to the applied science what Say's American Entomology was to the pure, viz., the foundation; and if Thomas Say was the "Father of Technical Entomology," then T. W. Harris is fully entitled to the honor of being called the "Father of Applied Entomology" in America. To these two men we owe the inspiration that has induced many an entomologist to commence his studies and encouraged him and sustained him in his later work. They were the pioneers of that period extending from 1800 to the death of Say in 1834, and and in the case of Harris this period continued up to 1855, his last paper on the Rose Bug (*Macrodactylus subspinosus*) appearing in the Boston Cultivator on September 8 of that year. It was Dr. Asa Gray, I believe, that wrote of Harris: "Of other genuine naturalists I have read but he is the only one I ever saw."

While Thomas Say has come to be honored by the title of "Father of American Entomology," he had already himself bestowed that or a similar title upon Rev. F. V. Melsheimer, and in his "American Entomology" he calls him the "parent of entomology in this country." In 1806, so far as I am able to determine, Rev. F. V. Melsheimer published the first general catalogue of North American coleoptera. In 1842 the Entomological Society of Pennsylvania was formed for the purpose of giving an impulse to the study of entomology by bringing together the cultivators of the science and preparing a catalogue of the coleoptera of the country. Owing to the fact that many species of coleoptera had been described in England and Europe, as well as in this country, and many species were to be found in the cabinets of American collectors without names, there was almost utter confusion and it was thought that a catalogue of all described species would, in a measure at least, reduce this chaos to system and facilitate the further study of this interesting order of insects. Accordingly the preparation of this catalogue was assigned to Dr. F. E. Melsheimer, son of Rev. F. V. Melsheimer, author of the first catalogue. This was prepared for publication and afterwards revised and enlarged by Dr. J. L LeConte and S. S. Haldeman, and published in 1853 by the Smithsonian Institution. And from this has evolved our check lists of North American Coleoptera.

After the death of Thomas Say in 1834 several gentlemen took up the work and as there had been several scientific bodies organized, and the publications of these offered facilities for printing the results of their labors, a considerable impulse was offered to the advancement of the science. Among these workers was Maj. LeConte and later his son, Dr. John L LeConte, who afterwards did so much for American coleopterology ; Dr. S, S. Haldeman, Professor N. M, Hentz. Dr. Christian Zimmerman and Edward C. Herrick. Among the work of foreign entomologists as related to American species we note especially that of Rev. Wm. Kirby, who was the author of that portion of Sir John Richardson's "Fauna Boreali-Americana" which treats of insects. This contained descriptions of no less than 447 species of Canadian insects, especially coleoptera, and was published in 1837, having since been revised and republished in the "Canadian Entomologist" by Dr. Bethune. In 1840 Mr. P. H. Gosse published in England a list of 26 butterflies, 43 moths and a number of other orders, 14 of which were figured. It was with these advances and in this condition that the beginning of the last half of the present century found the science of entomology in America. There was great confusion in regard to species and this seemed to prevent any rapid progress, both in the pure as well as the applied science, for the latter must always await the advance of the former. As I have stated, the Smithsonian Institution, by the publication of Melsheimer's Catalogue of the Coleoptera, greatly assisted workers in that order of insects but the good work stopped there and it was nearly five years before other orders were similarly treated in the publications of this institution.

The new and beautifully illustrated edition of Harris's Insects Injurious to Vegetation gave this work a renewed value and popularity, especially among the agricultural classes. In 1854 there appeared a series of volumes illustrating the agricultural and natural history of New York. Volume V. of the series was devoted to the more common and injurious species of insects. It is a large quarto volume profusely and brilliantly illustrated, but one for which entomologists have not been able to find any particular use.

In 1855 Dr. Asa Fitch received the appointment of entomologist to the New York State Agricultural Society, the Legislature having made provision for the establishment of the office which was synonymous with that of State Entomologist. The selection of Dr. Fitch was a wise one, and he promptly began to take up the work so well begun in Massachusetts by Dr. Harris, and for fourteen years his annual reports went out not only to aid the farmer to cope with injurious species, but also to aid the more technical entomologist, as a considerable number of the original descriptions of our insects are to be found therein. In 1856 the Canadian Bureau of Agriculture and Statistics offered prizes of £40, £25 and £15 for the best essays, respectively, on the "origin, nature and habits, and the history of the progress from time to time,—and the cause of the progress—of the weevil, Hessian fly, midge and other insects as have made ravages on the wheat crops of Canada ; and on such diseases as the wheat crops have been subject to, and on

the best means of evading or guarding against them." The first prize was awarded to Professor H. Y. Hind of Trinity College, Toronto, and his Essay on the Insects and Diseases of Wheat appeared in 1857, being the first publication relating to applied entomology, issued by the Canadian Government. In the meantime, the United States Department of Agriculture had secured the services of Mr. Townend Glover, an Englishman, born in Rio de Janeiro, South America, in 1813, and who, after much wandering about, had finally settled in the United States, about 1836. June 14, 1854, Mr. Glover received his appointment "For Collecting statistics and other information on seeds, fruits and insects in the United States" This was just about the time that the new Bureau of Agriculture was established, and attached to the United States Patent Office, and the Report of the latter for the year 1854 contains the first of a series of reports, on various insects injurious and beneficial to vegetation, though this was the exact title of the first only. The reports for 1854 and 1855 are fully illustrated. In the winter of 1856-57, Mr. Glover was ordered to British Guiana and Venezuela, and there is nothing from him in the Patent Office report for 1856; but in 1857 he again appears, though his articles are also signed by the Chief Clerk, D. J. Brown, by initials only, and this is true of the reports of the Patent Office for the years 1858 and 1859. The entomological paper for the year 1860 was prepared by Mr. P. R. Uhler of Baltimore, Md. Although Mr. Glover was not in evidence in these documents at this time, he was not idle, as will appear later. But the Government had now taken the initiatory step and recognized economic entomology. In the meantime Dr. William LeBaron of Illinois, afterwards State Entomologist of that State, began the publication of contributions on Injurious and Beneficial insects, in the "Prairie Farmer" in 1850, and continued to do so until 1874, two years prior to his death. Miss Margaretta Hare Morris, who began to study the habits of injurious insects in 1841, continued her work and publications up to 1860. Thus it will be seen that the applied science was making rapid strides, not alone as to the study of insects themselves, but in the diffusion of the knowledge gained by these studies, among the horticultural and agricultural masses, and the literature of these industries at this period is even now very interesting to economic entomologists. One can scarcely prepare a paper on many of our common insects without referring back to the volumes of the Prairie Farmer, The Country Gentleman, The Canadian Journal, The Canadian Naturalist and Geologist, and others of that character.

But how about the pure science? Has that branch been allowed to fall behind and the workers therein become discouraged? Though discouraged they probably were, many times, yet there does not appear to have been any lagging behind or giving over to despair. Dr. John L. LeConte did not terminate his labors with the preparation of Melsheimer's Catalogue of the Coleoptera; but the volumes of the Proceedings of the Philadelphia Academy of Science from 1852 to 1865 are filled with his descriptions, and, besides, there were many papers published in the Transactions of the American Philosophical Society, and other similar publications. In 1857, Baron R. Osten Sacken, of the Russian Legation at Washington, having been interested in the Diptera, at the solicitation of the Smithsonian Institution, prepared for publication a Catalogue of the described Diptera of North America, and including the West Indies, Central America and Mexico. In his preface to this Catalogue, which was published by the Smithsonian Institution, in 1858, Baron Osten Sacken expresses the hope that it will encourage the study of the Diptera, as rapidly as Melsheimer's Catalogue of the Coleoptera had furthered the study of that order of insects. In continuation of this work on the Diptera, there appeared, from the same Institution, in 1862, Part I, of the Monographs of the Diptera of North America, by H. Loew, edited, with additions, by Baron Osten Sacken. Part II, of the same series, appeared in 1864; Part III, by Dr. Loew alone, in 1873, and Part IV, by Osten Sacken alone, in 1869. Dr. John G. Morris, an entomologist of Baltimore, had been gathering materials, and in 1860 the Smithsonian Institution published a Catalogue of North American Lepidoptera, and a Synopsis of American Lepidoptera to accompany this, in 1862, though Part I only was published. In 1861, a synopsis of the Neuroptera of North America, by Dr. H. Hagen, LeConte's Coleoptera of Kansas in 1859, his Classification of Coleoptera of North America in 1862, his List of the Coleoptera of North

America, Part I, in 1866, his New Species of North American Coleoptera, in the same year, and Part II of both of these, published in 1873, together with the Catalogue of Orthoptera of North America, by S. H. Scudder in 1868, all printed by the Smithsonian Institution, show an amazing amount of activity among entomologists, during a decade when there was supposed to be little time for science, except that of war. Dr. LeConte himself dropped his studies, and went to the front to care for the sick and wounded, and give to the country his professional services. Dr. Breckenridge Clemens had published his admirable Synopsis of North American Sphingidæ in 1859, in the Journal of the Academy of Sciences of Philadelphia, and also during the same year a paper on the Arctiidæ in the Proceedings of the same institution. Others had published papers in the publications of the American Philosophical Society, the Boston Society of Natural History, and the New York Lyceum of Natural History. The various Explorations and Surveys, carried forward by the United States Government, for various purposes, furnished opportunities for making collections in the newer portions of the country, and the folio volumes dealing with the results of these expeditions are filled with valuable entomological papers.

In 1861 the Entomological Society of Philadelphia began the publication of its proceedings, the Society itself having been chartered in 1862, and six volumes of these were issued prior to 1866, when it was changed to the American Entomological Society, the transactions of which have been published quarterly up to date. In the first series, as above indicated, are found exhaustive papers by all of the most prominent entomologists of the times. In the first volume will be found the name of William Couper, and in the second that of William Saunders, among the contributors. Surely it cannot be said that there was any lack of activity during the fifth and sixth decades of the present century, among technical workers in entomology. But this is by no means all that had been accomplished. In 1862 there appeared, in the *Canadian Naturalist and Geologist*, a list of thirty-six persons, resident of Canada, who were interested in entomology, the list having been prepared by Dr. Bethune and Mr. William Saunders. On September 26th, 1862, ten of the gentlemen, whose names appeared in the above mentioned list, met in Toronto to consider the matter of a definite organization, This, however, was not accomplished until April 16th, 1863, when the Entomological Society of Canada was organized. The September meeting in Toronto was the first meeting of entomologists to be held in Canada, and you will pardon me the disgression if I call attention to the fact that on August 30th, 1889, there was also in Toronto another entomological society born, viz., the Association of Economic Entomologists, a body that was destined to include in its membership, not only every American economic entomologist, but every foreign worker in the applied science. No other society or organization has done so much to bring the workers in the world, in the science of applied entomology, together, in influence and effort, as has this one. No similar organization of the kind exists, and it has been of immense advantage to workers in the applied science in almost every country where entomology is known as a science. To Toronto then, must go the honor of being the birthplace of two of the most important entomological organizations in America. The Canadian Entomological Society, after seven years, was incorporated in 1871, under the name of "The Entomological Society of Ontario," and I esteem it a high honor to be allowed to address you at this its thirty-sixth annual meeting. The Quebec and London branches were established in 1864, and that of Montreal in 1873. In 1864 the newly organized Society published a list of 144 species of Canadian lepidoptera, followed in 1865 by a list of 350 additional species. In 1867, a list of 1231 species of coleoptera was issued, being ten times the number enumerated by Mr. Couper twelve years previously. In August, 1868, was issued the first number of "The Canadian Entomologist." Other similar periodicals have come and gone, with but two exceptions, viz, "Psyche" and "Entomological News," the first of which appeared in 1874, published in Cambridge, Massachusetts, and the second in 1890, and published in Philadelphia, Pennsylvania. Thus, the Canadian Entomologist spans almost one-third of the century of which I am speaking, and its columns have, from the first, been filled with original matter by almost every American entomologist of note living during this entire period. Its pages have

been open alike to the technical and applied science, and the series of volumes constitute a history of entomology in America, during this period. The first editor, Dr. Bethune, had had an eight year's training as entomological editor of the *Canada Farmer*, and was all the more fitted for the difficult task of editing an economic and at the same time technical entomological journal, and the result has been so satisfactory that I do not remember having heard of a single significant criticism being offered against either the publication itself or the nature of its contents. The entomologists of America owe to both Dr. Bethune and Dr. William Saunders a debt of gratitude for their faithful editorial labors. The twenty-nine annual reports of this Society are of great value, though not so free from compiled articles as is the "*Canadian Entomologist.*" In 1865, the Entomological Society of Philadelphia began the publication of the "*Practical Entomologist,*" with Mr. Benjamin D. Walsh, of Rock Island, Illinois, as associate editor at first, and later as editor. The publication was a very useful and valuable one, being, as the title implies, a strictly practical journal, but it was short lived as but two annual volumes were published. In 1868, that exceedingly valuable publication, the *American Entomologist*, was begun under the editorship of Benjamin D. Walsh and C. V. Riley, the former being killed by an accident soon after the close of the first volume. Unfortunately, this too was suspended at the end of the second volume, to be resumed again in 1880, when another volume was issued by Dr. Riley, and then it expired for good. In 1878, the *Bulletin* of the Brooklyn Entomological Society, was started, and six valuable though rather small volumes were published, when this, too, ceased to exist, being, with "*Papilio*," a magazine devoted exclusively to lepidoptera, and published in New York City, and comprising four volumes extending from 1881 to 1885, merged into "*Entomologica Americana.*" But this last, at the end of the sixth volume, after the fashion of the others, gave up the ghost. There is much that is valuable to be found in all of these publications, and they mark the growth of the science during the period of their existence. Not a few of the younger of our entomologists sent to them their maiden communications though there are no lack of papers by the oldest workers to be found among them. All of these entomological periodicals, including the "*Canadian Entomologist*," had their influence in encouraging the study of insects especially among young men, in much the same way that the entomologist's contributions to the agricultural and horticultural press have resulted in a closer attention to and a better knowledge of the common destructive insects by our intelligent up-to-date husbandmen.

The activity in the pure science has not been greater than in the applied. Valuable entomological papers by Uhler and S. S. Rathvon are to be found in the reports of the United States Department of Agriculture for 1860, 1861 and 1862, when Mr. Glover was re-employed, this time as Government entomologist, and up to 1878, each annual volume of the Departmental reports contains instructive papers on insects. The author himself derived much aid and encouragement from the paper on "The Food and Habits of Beetles" in the report for 1868. I can only call attention to that other immense work of Mr. Glover, viz., "Manuscript Notes from my Journal, or Illustrations of Insects," with the complete set of illustrations comprising 273 quarto plates, with 6,179 figures engraved on copper. A few institutions in the country have been able to secure a full set of these plates, colored by a competent artist. In 1867, a bill was passed by the Legislature of Illinois authorizing the Governor to appoint a State Entomologist. Through some technicalities he was not appointed, though the Governor recommended Mr. B. D. Walsh for the position; this gentleman would have been made State Entomologist in 1870, but for the terrible accident, on November 12th, 1869, that cost him his life. As it was, he was acting state entomologist at the time of his death, and in that capacity issued his first report. In 1870, Dr. William LeBaron was appointed state entomologist and held the office for four years, issuing in this time four annual reports. In 1875, Dr. LeBaron was followed by Dr. Cyrus Thomas, who held office until 1882, issuing in the meantime, six annual reports, when he was succeeded by Dr. S. A. Forbes, the present incumbent, whose reports contain the results of original work almost exclusively. In 1868 Mr. C. V. Riley was appointed State Entomologist of Missouri, serving in this capacity until 1877, when the office was abolished. The nine annual reports pub-

lished during this period, by Dr. Riley, are classics in American literature of applied entomology. In 1880, Dr. J.A. Lintner was appointed State Entomologist of New York, in place of Dr. Asa Fitch, resigned, and held the office until his death in 1898. While Dr. Lintner could hardly be termed an investigator, his series of carefully compiled reports, relating to the insects to which his attention had been called from time to time, afford a veritable encyclopedia of entomological information, for which more than one worker has felt devoutly thankful. In 1869, Dr. A. S. Packard, who had previously sent out some excellent entomological literature, issued his "Guide to the Study of Insects," the first work of its nature to be issued in America. In 1876, came his big folio volume, "A Monograph of the Geometrid Moths," from the United States Geological Survey, and lately we have had his "Bombycine Moths" and his "Text-book on Entomology," both of which are masterpieces. In 1877, the United States Entomological Commission was organized by an act of Congress, and placed under the authority of the Secretary of the Interior, afterwards being transferred to the Agricultural Department, its members comprising Drs. C. V. Riley, A. S. Packard and Cyrus Thomas. The object in creating this commission was to study the Rocky Mountain locust, but the members did not confine their investigations to these, by any means, and, as a result, we have several bulletins and five octavo reports, the latter containing over 3,200 pages, with 165 full page plates and a great number of smaller illustrations, and 10 large maps. The fifth and last volume was prepared by Dr. Packard, and relates to forest insects exclusively. In 1878 Dr. Riley was appointed United States Entomologist, but held the position for only one year, when he resigned, having in the meantime issued one report. The following year, Prof. J. H. Comstock was appointed to the office which he held three years, issuing two valuable reports and a special report on cotton insects. Since that time Prof. Comstock has given us some most excellent publications. His work on the Coccidæ is known universally among specialists of that group, while his later works "Insect Life" and "Manual for the Study of Insects," have been of great value to students and amateurs. In 1881, Dr. Riley was a second time called to the office of United States Entomologist, serving in that capacity until 1894, organizing a corps of original investigators, the like of which had not before been known in the history of the science. During these years the annual reports, bulletins and the serial "Insect Life" almost constitute in themselves an entomological library. The influence and zest that was thus given to the study of the applied science, and especially in the case of Experiment Station entomologists, can hardly be calculated. On the death of Dr. Riley the office of United States Entomologist very properly and deservedly fell to his long time first assistant, Dr. L. O. Howard, who has not only held the office creditably, but in some respects improved upon his predecessor. At the time of his death Dr. Riley was Honorary Curator of the Department of Insects, in the National Museum of Washington. Dr. Howard also succeeded his superior here, as in the Division of Entomology, but instead of a single aid, as under Dr. Riley, there is now a corps of conscientious, hard-working specialists, whose labors cannot prove other than creditable to American entomology.

In 1888 came the establishment of Experiment Stations, under the Hatch Act, and the office of Station Entomologist has been created in the majority of these institutions, which office is similar to that of State Entomologist, except that, in many cases, the entomologist is called upon to assume the duties of other departments of science, like botany or horticulture, or else devote a larger proportion of his energies to teaching in the Agricultural Colleges. This condition of entomological interests, in the Stations, has necessitated much hurried compilation and attempts towards popularization of old and well-known facts, so that the entomological bulletins of Experiment Stations do not stand as high in the estimation of scientific men as they otherwise would. Nevertheless, this is hardly the fault of the entomologists, but in the management of these institutions themselves, and besides, when we come to sift out the chaff, there remains much in the results of their work that is new and valuable. The workers themselves are too numerous for me to mention here. Theirs is current history, and their works will speak more for them than any words of mine possibly could. In Canada, Dr. Saunders's "Insects Injurious to Fruits," issued in 1883, with a second edition in 1892, has been a wonderful

public educator, in applied entomology, and the working entomologist will find that a copy at his elbow will be of the greatest service. It is one of the very best of its class that has ever gone out from the hand of an American entomologist. In 1887 Dr. James Fletcher was appointed Dominion Entomologist and Botanist and his work has been a herculean one. While he has given out annual reports, we all know full well that these but poorly represent his labor. What can one mind and one pair of hands do in such a sea of work as there is in Canada? It is like attempting to lower Niagara River by dipping the water out of Lake Erie with a teaspoon. You ought to have Dr. Fletcher, and a corps of at least half a dozen well trained and experienced entomologists, and God speed the day when you may have them.

But I must go back and mention a few others whose work has helped to make American entomology what it is to-day. As long as our Noctuidæ are known and studied, the name of A. R. Grote will be associated therewith, just as will the name of that gray-haired hero (if heroes there be among entomologists, and if not, why should there not be?), William H. Edwards, whose monumental work on the butterflies we may well be proud of, and which, except for Scudder's "Butterflies of the Eastern United States," is unique in our entomological literature. Then there is the work of Clemens, Chambers, French, Fernald and Robinson, as well as others that I have not time to even mention, but who have made their reputations among us. In the Coleoptera there was Dr. Horn, who, either associated with Dr. Le Conte or independently, has done as much or more for American coleopterology than anyone else, although there are others whom I might mention. The life-work of Mr. S. H Scudder is a good example of American activity, as, besides his work on the insects of the present age, he has given the world as well as America such monographs on fossil insects as have never been done before. But time will not allow me to say more, except to mention the industrious labors of Abbé Léon Provancher, and his "Le Naturaliste Canadien," a work that was carried out under discouragements that the most of us cannot appreciate or understand.

In looking back over the field, then, there appear several conspicuous achievements in applied entomology that rise up, like the cloud-capped eminences of huge mountains, from the comparatively level plain. The spraying of fruit trees, bushes and vines to destroy insect pests is an innovation that has saved America millions of dollars annually. The work of the Massachusetts Gypsy Moth Commission is a revelation to those who have never investigated its wonders and merits. The introduction of beneficial insects, both as a means of destroying the destructive ones, and for the purpose of fertilizing the bloom of exotic fruits or plants, is another modern innovation. It will be remembered that, ten years ago, the orange groves of California were threatened with destruction from the Cottony-Cushion Scale, *Icerya Purchasi*, Maskell. After much correspondence with Mr. Frazer S. Crawford, of South Australia, one of the kindliest and most lovable men that it has been my good fortune to meet, and who, except Dr. Riley himself, did more than anyone else to further and bring about the introduction of the natural enemies of the Icerya into California, Mr. Albert Keobele was sent to Australia in order to introduce the insect enemies of this pest into this country. How this was accomplished and the results that were obtained has been told again and again, and covered with glory, not only the United States Department of Agriculture and the State Board of Horticulture of California, but quite properly Mr. Keobele as well. It is, however, but just to say that Mr. Crawford not only was very influential in furnishing the information necessary to the undertaking, but himself forwarded the first *Dipterous* parasites *Lestophonus iceryæ* to this country, and did everything possible to assist the entomologists that afterwards visited South Australia; and for American entomologists to forget for a moment, his connection with the undertaking would be most deplorable. As you know, this introduction of Mr. Keobele's was successful, and similar experiments in sending the *Novius cardinalis* to other countries has also been crowned with success. But another achievement came from the studies of this scale, viz., the application of hydrocyanic acid gas to destroy scale insects. This last honor falls to Mr. D. W. Coquillett, now of the National Museum. Although in a sense forestalled by the introduction of the humble

bee into New Zealand to fertilize the bloom of red clover, *Trifolium pratense*, yet the recent success in introducing and establishing *Blastophaga psenes* into California to fertilize the Smyrna fig adds a well-deserved honor to the office of United States Entomologist at present so creditably filled by Dr. L. O. Howard.

Although important from an educational rather than an economic or technical standpoint, nevertheless I cannot forego calling attention to Dr. W. J. Holland's "Butterfly Book" as paving the way for a better method of presenting the science of entomology to the young or inexperienced. That it should be possible to place such a superb book as this in the hands of our young people, and withal so entertaining, at the price of $3.00, is an innovation in teaching our beloved science.

And now, standing as we do on the threshold of a new century, it does seem as though we might look back over the last with honest pride. From almost nothing we have become the leaders of the world in applied entomology, and we are certainly not exasperatingly far behind in the pure science. International questions of the technical sort have, many of them, yet to be settled, and we may find, after all, that we are not less in error than our fellows in other lands. At any rate, we have accomplished enough to give us the best possible encouragement for future labors, and it is to be hoped that the white-haired veterans that are still with us, and have done so much to make this condition of affairs possible, will live many long years to watch and enjoy our further progress.

As to the future, it seems to me that the work of the entomologist will differ somewhat from that of the past. Except in some groups most of the descriptive work is done, and all that remains is to prove the validity of species, for we have learned one other thing in the past, and that is, that the Almighty can make a better species than the entomologist, though probably nowhere near as many of them. Canada will probably offer a more fruitful field for the collector, for some time to come, than the United States, because it has been less worked, but you also have problems in distribution, variation, development and inter-relations with other organisms, and it is in these directions that I expect to see the science making the greatest progress. If we have a world conquered behind us, there are others in front us to conquer. There is something and enough for everyone to do, and do well. May the Entomological Society of Ontario and its members live long and continue to work faithfully, for the fields are crying out for workers, and the prospects encouraging, and as I have stated before, entomology knows no political lines, but is as boundless as the ocean and as free as the air. So may it ever be.

At the close of Prof. Webster's paper, which was listened to with great attention, another address illustrated with lantern pictures, was given by Prof. Lochhead.

LECTURE ON SOME COMMON INSECTS OF THE ORCHARD, GARDEN AND FARM.

The speaker first dealt with the Scale insects which occur in many orchards, and do a vast amount of harm. The San Jose Scale, the Oyster-shell bark-louse, the Scurfy bark-louse, and the plum Lecanium were each in turn described from the lantern illustrations. The general adoption of spraying with whale-oil soap (2 lbs. to 1 gallon of water) during the dormant season would soon keep the majority of these small scale insects in check. To insure further immunity the speaker advised the use of dilute kerosene emulsion spray during June when the young forms (if any survive) are moving about.

The Codling worm and the Bud worm were next discussed. Their habits and life histories were concisely described, as well as the remedies which were used against them. The insect pests which make webs or tents, viz. : the fall web-worm, and the two species of tent caterpillars, were described, and remedies given, which, if applied properly, would certainly diminish the damage done by these very injurious moths. The use of Paris green spray is recommended while the worms are small, but much might be done by hand-picking the egg-masses of the tent-caterpillars during fall and winter.

The borers, the flat-headed and the round-headed forms could be controlled by the application of a tar wash to the trunks of the trees after many of the worms had been killed by probing the tunnel with a stout wire.

The pea-weevil was described as a very serious pest, for probably one-half of the pea crop of Ontario was destroyed by its ravages. Its life-history was sketched and the carbon-bisulphide remedy was mentioned as probably the most effective.

Among garden insects the Colorado potato beetle, the cabbage-worm, the white grub, and the wireworms were illustrated, and remedies given for their control.

Finally, the speaker dealt somewhat fully upon a few beneficial insects which are too often killed by the farmer and gardener, named, the *lady-birds*, which prey upon plant lice and scale insects, and the *ground beetles* which feed upon grubs in the soil, and even climb trees in search of food. The speaker spoke strongly of the necessity of recognizing the beneficial from the harmful insects, if the best results are to be attained in the warfare against insect pests.

The proceedings were brought to a close by a few remarks from Dr. Bethune, who expressed the thanks of all present to those who had furnished them with such an agreeable and instructive evening. The majority of the audience then visited the Society's room in another part of the building where they were much delighted with the exhibition provided by Mr. Moffat, of many drawers from the Society's cabinets, filled with wonderful and beautiful insects of various orders. The success of the illustrated lectures was largely due to Mr. R. W. Rennie, who fitted up the lantern and manipulated the slides.

THURSDAY, OCTOBER 12th.

The session of the Society was resumed at 10 o'clock a.m., Dr. Fyles occupying the chair at the request of the President. The minutes of last year's meeting were adopted as printed in the annual report. The chairman then called upon the various officers of the Society and its Branches and Sections to read their respective reports upon the transactions of the past year. The first in order was that of the Council, which was read by Dr. Bethune, as follows :

Report of the Council.

The Council of the Entomological Society of Ontario begs to submit its annual report for the year 1898-99.

The thirty-fifth annual meeting was held in Montreal in November last in order that we might join in the celebration of the twenty-fifth anniversary of the Montreal branch. It was well attended by members from a distance as well as by those resident in the city, and the proceedings were of a highly interesting and useful character. A full account has already been published, rendering it unnecessary to enter into details. The branches in Toronto and Quebec are also in a prosperous condition, and have been the means of largely increasing the membership of the Society.

The twenty-ninth annual report on economic and general Entomology was presented to the Minister of Agriculture for Ontario early in February last, and was printed and distributed at the beginning of May. It contained one hundred and twenty pages, and was illustrated with sixty seven wood cuts and two plates, portraits of Messrs. W. H. Harrington and J. Dearness, who have recently held the office of President of the Society. In addition to an account of the proceedings at the last annual meeting the report contains the address of the President, Mr. Henry H. Lyman and the following valuable and interesting papers : "Some economic features of international Entomology" and "The collector and his relation to pure and applied Entomology," by Prof. Webster ; "The farmer's garden and its insect foes," by Rev. Dr. Fyles ; "Entomology in Schools," by Prof. Lochhead ; "The cotton boll worm in Canadian corn" and "Two avian parasites," by Messrs. R.

Elliott and J. Dearness; "A bit of history" and "Random recollections in Natural History," by J. A. Moffat; "The Noctuidæ occuring at Toronto," and "Muskoka as a collecting ground," by Mr. Arthur Gibson; "Notes on Papilio brevicauda," by Mr. A. F. Winn; "The Gypsy Moth," by Mr. E. H. Forbush; "The preparation of specimens for the exhibition of life histories in the cabinet," by Mr. Dwight Brainerd; "The brown-tail Moth" and "Injurious Insects in 1898," by Dr. Fletcher; and "Notes on Insects of the Year," by Messrs, Harrington, Evans, Kilman, Rennie, Hutt and Moffat. In the excellence of the papers and their generally practical character, the volume has well maintained its high standard of usefulness.

The *Canadian Entomologist*, the monthly magazine published by the Society, completed its thirtieth volume in December last. It consisted of 335 pages and was illustrated with six plates and twenty one original wood-cuts; the contributors numbered fifty-three. It was filled with original papers of a high order of merit, and may justly be considered one of the most valuable and interesting volumes since the inauguration of the magazine. Of the thirty-first volume ten numbers have now been issued, containing 304 pages, five plates and thirty-six wood cuts. Among the large number of valuable papers may be mentioned a series of articles on the "Classification of the Entomophilous Wasps," by Mr. William H. Ashmead; and numerous papers on Coccidæ, by Profs. Cockerell, and Tinsley, Messrs. King, Fowler, Parrott and others; a List of Manitoba Moths, by Mr. A. W. Hanham; a continuation of a series of papers by Prof. Wickham, on the Coleoptera of Canada, and Mr. E. M. Walker, on the Acridiidæ of Ontario; life histories of Lepidoptera, by Dr. Dyar; Descriptions of new genera and species in various orders by Messrs. Scudder, Quaintance, Coquillett. Skinner, Smith, Banks and others; and papers on a great variety of subjects of a techincal or practical character by leading Entomologists of America and several distant countries.

The council have learned with much satisfaction that an Entomological Society has been successfully organized in the North-West Territories of Canada, under the presidency of Mr. Percy B. Gregson, of Waghorn, Alberta. They desire to express their heartiest wishes for its success and prosperity and to assure its members of their readiness to co-operate with them in any way in their power. The field is a vast one and its scientific resources are as yet unexplored and almost unknown.

At the meetings of the Association of Economic Entomologists and the American Association for the Advancement of Science, held at Columbus, Ohio, in August last, the Society was represented by Dr. William Saunders, Director of the Experimental Farms of the Dominion.

The Council has watched with interest the vigorous efforts made by the Government of Ontario to prevent the spread of that dread pest of the fruit-grower, the San Jose Scale, and is pleased to learn of the success which has attained the experiments made by Prof. Lochhead in fumigating with hydrocyanic acid gas. It was gratified to learn that one of its members, Mr. J. Dearness, formerly President of the Society, was appointed by the Hon. the Minister of Agriculture, one of the Commissioners for the investigation of the ravages of the Scale in Ontario.

The members of the council are pleased to note the appointment of Mr. Arthur Gibson, President of the Toronto Branch of the Society, to the position of assistant in the Division of Entomology of the Dominion Experimental Farms.

As will be seen from the report of the Librarian and Curator some valuable additions have been made to the collections both of books and specimens.

All of which is respectfully submitted.

HENRY H. LYMAN, President.

REPORT OF THE LIBRARIAN AND CURATOR.

For the Year Ending 31st of August, 1899.

An important addition was made to the library during the past year, by the purchase of some of the more recent works in the various departments of the Natural Sciences, numbering 28 volumes; which will give the members of the different sections associated with the society an opportunity of consulting the latest and best authors in the particular branches of science to which their attention is being directed.

Twenty bound volumes were received from Governments, Public Institutions and Societies during the year.

Of the proceedings and transactions of Societies, Magazines and Pamphlets, there were made up and bound 25 volumes; 1 volume was donated to the library by Mr. Goodburn; making a total of 74 volumes added during the year. The full number on the Register is now 1,627. Books issued to local members numbered 50.

A few specimens of local interest, new to the collection, have been added during the year. An opportunity presented itself of obtaining some Manitoba Lepidoptera, correctly determined, which was secured, and will be—and has already been—of service in identifying other material.

Some interesting additions to the collection of exotics have been made at different times by Mr. C. T. Ramsden of Santiago de Cuba; one of our members at present resident there.

Respectfully submitted,

J. Alston Moffat.

Mr. J. A. Balkwill presented his financial statement as Treasurer of the Society and stated that the balance on hand would all be required to meet the ordinary expenditure during the remainder of the year.

AUDITORS REPORT.

Receipts and expenditures of the Entomological Society of Ontario for the year ending August 31st, 1899.

Receipts.		Expenditures.	
Balance on hand Sept. 1st, 1898	$ 739 25	Pins, Cork, etc	$ 91 04
Members' Fees	390 90	Annual Meeting and Report	285 25
Sales of Pins, Cork, etc	89 23	Library	125 48
Government grant	1000 00	Printing	597 21
Advertising	13 00	Expense Account, (postage, etc.)	108 94
Interest	17 73	Salaries	300 00
Sales of Entomologist	34 11	Rent	200 00
		Balance on hand, August 31st, 1899	576 30
	$2284 22		$2284 22

We the Auditors of the Entomological Society of Ontario hereby certify, that we have examined the books and vouchers of the Treasurer and find them well kept and correct and the above is a true statement of the accounts of the Society.

London, Sept. 15th, 1899.

W. H. Hamilton,
James H. Bowman, } Auditors.

A discussion on the subject of the purchase of a Magic Lantern was introduced by Mr. John Law, who thought that the Society ought to have one for exhibition purposes. Prof. Lochhead gave some information regarding the cost of a lantern and slides. After remarks by Messrs Dearness, Fletcher, Bethune and Bowman, it was resolved that "The consideration of the question of purchasing a Magic Lantern be referred to the library committee to obtain all the information possible about it during the year, and that they be authorized to purchase slides and to rent a lantern at such times as may seem advisable."

The next business of the meeting was the election of officers for the ensuing year, which resulted as on page 2.

Honorary Members.—The following gentlemen were unanimously elected Honorary Members of the Society :—Dr. L. O, Howard, United States Entomologist, Washington, D. C.; Professor John B. Smith, Sc. D., Rutgers College, New Brunswick, N. J.; Professor F. M. Webster, Wooster. Ohio; Professor H. F. Wickham, Iowa City, Iowa.

REPORT OF THE GEOLOGICAL SECTION.

The Geological Section of the Entomological Society of Ontario begs leave to present the following report :

The meetings of the section were held weekly as usual, and a gratifying amount of interest in the study of geological science was evinced.

The noteworthy features of the year's study were the following : (*a*) An examination of local geology, including discussions respecting the origin of the flowing sulphur springs; (*b*) an investigation of the extent of local peat beds; (*c*) visits to Kettle Point; (*d*) visits to Western Ontario oil fields; (*e*) and a very interesting account of a visit to the Parry Sound district. Besides these visits Mr. Percival revisited the Strontium cave at Put-in Bay Island, Ohio. Mr. Goodburn also visited the Lake Superior copper region, and will report on it.

Local Geology.

London is situated in a wide valley eroded by the river, whose two main branches unite at this point. It is probable that the course of the river has been changed here more than once, and that at one time the north branch flowed east by way of Carling's Creek and joined the east branch on the eastern limits of the city, and that the channel of the east branch is now several hundred feet south of its ancient location. The boulder clay is here deeply overlaid by clean water-washed sand, with quicksand in many places. The distance to bedrock is about 120 feet in the lower parts of the city. On the highlands surrounding it is much more. At Mt. Brydges, 20 miles west, it is 300 feet. Thus the depth of the drift and boulder clay is a feature of the locality. In the eastern part of the city pure water is obtained abundantly in the drift, but lower down than the boulder clay no water suitable for domestic use in quantity has been found until great depths are reached. On the other hand, at the Forks, and generally in the western portion of the city, sulphur springs are found in the upper rock strata. A sulphur spring, flowing 40 cubic feet per minute, struck about thirty years ago, continues to flow in undiminished volume. The water rises to a height of 24 feet above the surface, and formerly was utilized to turn a wheel and made to do useful work at street watering until the sulphuretted hydrogen created a nuisance on the streets and in the shops where iron goods were sold. Analysis of the water shows it to be highly mineralized, and it is reputed to be valuable as a remedy in cases of certain skin diseases, particularly eczema. Facilities for bathing have been provided, and are patronized by the general public. The quantity of sulph. hydrogen is not large, though from its offensive odour it would appear to be exceedingly abundant. The gas probably has its origin in the decomposition of the gypsum beds of the Onondaga group, and coming from higher levels to the eastward flows as before noted. The temperature of the water is 48°, and in summer seems icy cold. It is scarcely possible that it comes from any great depth, as if it did so its temperature would be considerably higher.

Dr. Woolverton, chairman of the Section, revisited Kettle Point and its vicinity during the summer. In addition to the rocks noticed last year he traced an outcrop of Corniferous limestones, distant about two miles from the present shore of Lake Huron and parallel to it. A species of large spirifer (*Spirifer increbescens*) was abundant. The specimens collected were much larger than *S. mucronatus*, abundant near Thedford. The rocks are lower than those of Thedford and Arkona. They form an old shore line, and between them and the lake are extensive sand dunes. Economically they furnish a coarse lime for rough building purposes, but contain too much iron for use in buildings of the better class. An old Indian trail crosses this lime bed. The Indians throughout Lambton County have a general tradition that a silver lead mine exists somewhere in the vicinity. Among other places No. 4 hill in Bosanquet, three miles from Arkona, is pointed as the location of the mine, but the Doctor was unable to find any trace of it. Another locality pointed out is a bluff on Black Creek, near Oil Springs, where it is said the Indians formerly made their own bullets. Like the Indian idea that a seam of coal exists under water at Kettle Point, the notion that a galena vein exists in Lambton is not generally believed.

Strontium Caves.

Mr. Percival paid a second visit to the Strontium sulphate cave at Put-in-Bay Island. Another cave of large size, named Dossard's, has been discovered on an adjoining lot. It contains some crystals of Strontium, and has stalactities and stalagmities. It is in the form of a crescent, and is said to be 700 feet in length. Like Perry's cave in the same vicinity, it is in limestone rock.

Peat Beds.

A number of the members of the section visited a peat bed, situated about 3 miles west of London at Redmond's farm. It lies in a low spot bordered by high hills on the east and north. Towards the south a barrier not more than a few feet in height isolates it from the River Thames. In the centre is a pond of clear spring water over 60 feet in depth. This spring is capable of furnishing one million gallons per day of excellent water, and as it is only about $\frac{3}{4}$ mile from Springbank it will probably in time become valuable. This water finds its way through gravel beds into the river. The surface of the pond is 109 feet above the river. Around the margin of the bed is a tangled growth of firs, willows or other shrubs. Farther in are cranberry and other low bushes, while thickly covering every available spot is a feathery moss called Sphagnum, with occasionally pitcher and other aquatic plants. This peat bed covers about 48 acres, and is quite deep over most of the surface. A depth of 60 feet has been measured during the winter season when the pond is frozen over. Members of our Section measured it where practicable, and found from 8 to 20 feet of good peat in its outer zone. Mr. Kirk and others have tested its quality as a fuel, and have found it to be of a high standard. Some of it is remarkably dense for peat, and when air-dried for a few days it requires considerable force to break it. The specific gravity of one sample was but little below 1, which is about four times as dense as peat usually is. It is easily kindled, burns with a bright flame, gives off great heat, and burns almost entirely away. Only an insignificant amount of ash remains. The ash is light and flaky, and is entirely free from slag or clinkers.

As Ontario possesses at a moderate estimate 1,000,000 acres of peat, the economic value of this hitherto neglected fuel is very apparent. It will soon be appreciated on this continent as it has been for so long in the Old World. Coal contains from 1 to $1\frac{1}{2}$ per cent. of sulphur, and this forty to sixty pounds of sulphur per ton has a most damaging effect on the iron smelted by its agency. Peat contains no sulphur, and is to be used in our new iron furnaces at Orillia. For domestic use it is soon to be put on the market at Stratford and elsewhere. A company is now being formed to develop our local beds. Sphagnum is the best material for paper-making, and a cloth for making antiseptic bandages is being now made from it. For steam raising peat is an ideal fuel, filling the firebox with flame, while it is without the disadvantage of the sulphur which corrodes the firebox and tubes of the boiler. Being almost smokeless it would be most welcome as a domestic fuel, and for factory use. When destructively distilled peat yields besides vari-

ous useful compounds obtained from coal, about 10,000 cubic feet of gas. Peat gas is more easily purified than gas made from coal, and it leaves no vile-smelling lime compounds to be got rid of as is the case with coal. About 100,000 cubic feet of water gas can be obtained from one ton of peat, and this gas without enriching can now be used for lighting through the discovery of the incandescent mantle. As a fuel gas it would be very cheap and of great heating power, as it is largely composed of hydrogen, whose heating capacity is more than four times that of an equal weight of coal gas. For heating it would be nearly as cheap as natural gas, and next in convenience and cleanliness to electricity, used for that purpose, and at a hundredth part of the cost of the latter.

Other peat beds are known to exist in the neighborhood. A majority of the members of the section paid visits to the peat beds among whom may be mentioned Dr. Woolverton, Mr. Percival, Mr. Sangster and Mr. Kirk.

Oil Wells.

Dr. Woolverton reported on the developments in the Dutton oil district. During the year several wells, producing at first 25 bbl. a day, were struck. The production diminished in a short time to 1 to 2 bbl. The Standard Oil Company is actively developing in that district.

Mr. Kirk visited the Sarnia oil district where the Standard Co'y is also developing a new oil territory. A well which produced 40 bbl. a day was struck there during the month of July last. It continued to produce at that rate for about 3 weeks after which it gradually fell off to about 10 bbl. a day. The average production of the wells in the Sarnia district is about 1 barrel a day.

Parry Sound District.

Dr. Woolverton spent several weeks in the Parry Sound district and made a most interesting report on its rock formations., characteristic minerals and its prospects as a mining region. 'The Huronian rocks,' he said, 'are much disturbed throughout the whole region, and dip in every direction, while intrusive rocks are very common. Most of the surface rocks were metamorphic, the capping being usually gneiss. The boulder-strewn surface is covered with a dense carpet of lichens. Among other samples collected here are marbles, pure quartz of various shades from white to quite dark, jasper conglomerates, mica, Bornite, Chalcopyrite and Copper pyrites. These garnets were obtained from Parry Harbor. The mica specimens, of excellent colour and of merchantable size, are found about seven miles from Parry Sound. A strongly mineralized zone extends from Parry Sound to the Muskoka lakes, a distance of about 20 miles south east, while far to the north the region is well mineralized. A number of companies with sufficient capital are actively pushing the development of copper prospects and properties have changed hands at high prices. Mention may be made of the development work being done by The McGown Mining Co., The Wilcox Co'y., The Le Fex Co'y., The Parry Sound Co'y., C. Copper Co'y. and The Bornite, the latter being a local concern. Not much nickel has yet been found. The Bornite is found in rich pockets. A sample lot of six carloads netted the owners about $5000. Copper pyrites is extensively found and is quite rich in copper.'

S. Woolverton, Chairman.

REPORT OF THE MICROSCOPICAL SECTION.

The section was organized on Oct. 22, 1898, with the following officers:—J. A. Balkwill, Chairman; S. Silcox, Secretary, J. H. Bowman and W. H. Rennie, committee.

Eight meetings were held during the winter, beginning Nov. 12th and on each 2nd and 4th Saturday thereafter. At several of these the subject of Ecology was taken up, following notes obtained at Chicago University by W. T. McClement, M. A. of the

Armour Institute, Chicago. Many interesting sections of plants from various sources, microscopical plants and organic salts were presented for examination at the meetings.

Papers were read on the Agaricinae by J. H. Bowman; Starch by J. Dearness; microscopical examination of crystals by J. H. Bowman, and these papers were reviewed: "Staining Algae" by J Chamberlain, Chicago; "Histology of plants in relation to their environment" by W. T. McClement, Chicago.

J. A. BALKWILL, Chairman.

S. SILCOX, Secretary.

REPORT OF THE MONTREAL BRANCH.

The 216th* regular and 26th annual meeting of the Montreal Branch of the Entomological Society of Ontario was held at 74 McTavish St. on 9th May, 1899.

The members present comprised Messrs. Henry H. Lyman (President), A. F. Winn (Vice-President), Dwight Brainerd, J. B. Williams, A. E. Norris, M. W. Davis, Rev. W. A. Fyles, G. A. Moore, G. Chagnon, and L. Gibb; visitor Rev. E. C. Trenholme.

The chair was taken by the President and the minutes of the previous meeting were read and confirmed and the minutes of the last annual meeting were also read.

The President then submitted the following report of the Council for the past year:

REPORT OF THE COUNCIL.

In presenting their twenty-sixth annual report the Council have much pleasure in referring to the fact that the season just closing has been the most memorable in the history of the Branch, owing to the highly successful celebration of the 25th anniversary of its formation, which was held on the 8th of November.

Special mention should also be made of the holding, in connection therewith, of the annual meeting of the parent society which gave our members an opportunity of meeting such pioneers in Canadian Entomology as Dr. Bethune and Dr. Saunders and of taking part, as members, in an annual meeting of the parent society.

Since our last annual meeting three new members have been added to our roll, one being transferred from the parent society. During the year eight meetings have been held, at one of which we had the pleasure of the attendance of Rev. Dr. Fyles and at another of Dr. Fletcher, and the following papers were read and addresses given:—

Annual address of the President, H. H. Lyman.

Notes on ovoposition of a clothes moth when in a dying condition, E. T. Chambers.

Life history of Xylina Bethunei, H. H. Lyman.

Notes on collecting in British Columbia, D. Brainerd.

On arranging Lepidoptera to illustrate family groups, J. B. Williams.

The early days of the Montreal Branch, sent by Mrs. A. L. Jack.

Notes on a few moths, H. H. Lyman.

The basket worm, Thyridopteryx Ephemeræformis, A. F. Winn.

Observations on the emergence of the imago of Papilio Brevicauda, A. F. Winn.

Notes on the Genus Grapta, H. H. Lyman.

Address on his ascent of Mt. Cheam, Dr. James Fletcher.

Address on the Medico legal aspects of entomology, Dr. Wyatt Johnston.

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*Last year's annual meeting was supposed to be the the 215th, but it was found that in 1889 a mistake had been made in the count which has now been corrected.

On the protection of Lepidoptera from mites and other pests, A. E. Norris.

Notes on Danais Archippus, H. H. Lyman.

The President also attended a meeting of the Toronto Branch and read a paper before it. The annual course of half-hour lectures to young people at the Natural History Society again received the assistance of several of our members.

The average attendance at the meetings has been a fraction over 10, being the highest average in the history of the Branch.

The Treasurer's report shows that the finances of the Branch are in a satisfactory condition, and the Council would suggest that some provision be now made for the care of such books as the Branch possesses, that they may be readily available for the use of the members.

A number of our members took part in the annual field day of the Natural History Society at Rigaud, on 4th June, and another field excursion was made to St. Rose and St. Therese on the 1st July, in which four of our members participated.

Respectfully submitted on behalf of the Council.

HENRY H. LYMAN.
President.

The Treasurer then submitted his report, which showed an accumulated balance in hand of $45.26.

Upon the motion of Mr. M. W, Davis, seconded by Mr. A. E. Norris, the reports of the Council and Treasurer were received and adopted.

The President then read his annual address, making it his valedictory upon retiring from the presidency, reviewing the past history of the Branch, and giving many interesting details of the early years.

A vote of thanks to the President for his address was carried, and the Secretary was instructed to copy the address in full in the minutes.

The following officers were then elected for the ensuing year :

President, Albert F. Winn ; Vice-President, Dwight Brainerd ; Secretary-Treasurer, Lachlan Gibb ; Council, Henry H. Lyman, G. C. Dunlop, A. E. Norris,

The retiring President then vacated the chair, which was taken by the new President, who read an interesting paper on "Collecting at Electric Light."

After discussion and the examination of specimens brought by the members the meeting adjourned.

LACHLAN GIBB,
Secretary-Treasurer.

REPORT OF THE TORONTO BRANCH.

The third annual meeting of the Toronto Branch of the Entomological Society of Ontario was held in the Education Department (Normal School) on Friday evening, the 7th April, 1899.

The following members were present: Messrs. Cherry, Stewart, Walker, Fenwick, Wilby, Austen, Kinghorn, Gibson (Secy.-Treas.), Carter and Tyers ; visitor : Mr. Wm. Watkins.

In the absence of the President and Vice-President, the Secretary was requested to act as Chairman.

The minutes of the previous regular meeting were read and approved.

The Secretary read the following report of the Council for the year ending 31st March, 1899 :

REPORT OF COUNCIL.

The Council of the Toronto Branch of the Entomological Society of Ontario take pleasure in presenting the third annual report of the proceedings of the Branch for the year ending 31st March, 1899.

They have much gratification in stating that, since the last annual meeting, four new names have been added to the roll of membership, viz., Messrs. E. M. Walker, G. M. Stewart, Allan Kinghorn and Donald Wilby, and the hope is expressed that all the members will endeavor to obtain other new additions in the near future.

During the past year twenty regular meetings have been held, the following papers being contributed from time to time :

"Relations existing between plants and insects," by Mr. S. R. Carter.

"Muskoka as a collecting ground," by Mr. A. Gibson.

"Notes on the collection and preservation of Botanical specimens," by Mr. S. R. Carter.

"The life history of Xylina Bethunei," by Mr. H. H. Lyman, of Montreal.

"The evolution of the insect," by Mr. E. M. Walker.

"What value is to be derived from a study of Entomology ?" by Mr. A. Gibson.

"Head appendages of the Orthoptera," by Mr. G. M. Stewart.

During the collecting season three field days were held, viz., on the 24th May to Silver Creek, on the 11th June to High Park, and on the 18th July to High Park.

In December last, certain of the members being interested in plant life, the suggestion was made that a Botanical Section be formed, and the following motion was made by Mr. Carter, seconded by Mr. Walker, and duly carried : "That in view of certain members of the Society being interested in the study of Botany, a section be formed with the object of encouraging this branch of Natural Science, with the hope of securing new additions to the roll of membership, and also in view of the close relationship existing between the entomologist and the botanist, particularly from the entomological standpoint."

The report of the Librarian-Curator shows that the library and collection of insects is steadily increasing. Quite a large number of Government publications and other valuable books have been added to the library during the year.

The Treasurer's report shows a satisfactory balance on hand of $9.43.

All of which is respectfully submitted.

R. J. CREW,
President

The report of the Treasurer was presented as also that of the Librarian-Curator, submitted by Mr. Gibson. On motion of Mr. Austen, seconded by Mr. Cherry, the reports of the Council, Treasurer and Librarian-Curator were adopted as read.

The election of officers for the ensuing year resulted as follows: President, Mr. Arthur Gibson ; Vice-President, Mr. E. M. Walker ; Sec'y-Treas., Mr. G. M. Stewart ; Librarian, Mr. H. C. Austen ; Members of Council, Messrs. R. J. Crew and S. R. Carter.

In the absence of the President the Secretary then read Mr. Crew's address, which was listened to with much interest and which contained many valuable suggestions. He mentioned that it was gratifying to know that the branch had enrolled four new members during the year, which strengthened it a good deal and hoped the members would encourage others to join and take an interest in the work. Among other things Mr. Crew suggested that during the following winter certain of the meetings be set aside for certain subjects, all the members bringing as much information as they can about these subjects to the meeting in order that all may take part in the discussion and get the full

benefit of the remarks. In this way he thought much interesting work could be accomplished. And if certain evenings were also set aside for dissecting and studying the anatomy of certain insects much useful information would thus be available. He also touched upon the newly formed Botanical Section, which as yet has not taken much shape, but the hope was expressed that other botanists might be induced to become members and thereby strengthen the branch. Mr. Crew, in conclusion, thanked the members for the honor they conferred upon him in electing him as their President for the year just closed.

The meeting then adjourned.

ARTHUR GIBSON,
Secretary.

REPORT OF THE QUEBEC BRANCH.

The annual meeting of the Quebec Branch of the Entomological Society of Ontario was held on the 15th April, 1899, fourteen members being present; the President, Rev. Dr. Fyles, occupying the chair.

PRESIDENT'S REPORT.

The Quebec Branch of the Entomological Society has commenced the third year of its existence. It was formed on the 24th March, 1897, and the time since has been marked by steady growth and increased usefulness.

The annual meeting of 1898 was held at the house of the Secretary-Treasurer of the Association and was a happy and successful gathering. During the year following three very pleasant meetings were held at the homes of members: Mr. Thos. Poston, Levis; Mr. J. E. Treffry, Quebec; Mr. James Geggie, Beauport, and seven were held at Morrin College.

Field days were also pleasantly spent at Bergerville (June 5th), the Island (June 18th and August 4th), and at Levis Forts (July 21st). On these occasions many interesting captures of insects were made and much information concerning them imparted.

In the course of the year papers were read or addresses given on the following subjects:

The destruction of the forests, the Apidae, the Coleoptera, Garden Pests, Silk-worm moths, Arsenical spraying and Honey Bees, the Book of Nature, Spiders, Crickets, Wasps.

At one of the meetings beautifully illustrated Entomological works were exhibited by Miss Bowen, and a most interesting history of the Entomological Society of Ontario, written by Rev. Dr. Bethune, one of the founders of that society, was read by Miss Palmer, B.A.

The captures made during the year included the rarities: *Catocala bianca*, *Platarctia parthenos*, *Spilosoma congrua*, *Lophopteryx elegans*, besides several undescribed species.

Of destructive pests, the only noteworthy appearances in this Province in 1898 were those of the Tent Caterpillars, *Clisiocampa Americana* and *Clisiocampa disstria*. These were so numerous last summer in parts of the counties of Drummond and Shefford that they stripped the second growth trees bare. Should the coming season prove favorable to their increase they will probably do much harm. A forked stick thrust into the webs in the early morning or late in the evening when the caterpillars are "at home", and twisted round, will entangle the creatures in their habitations, which can then be drawn from the tree and trodden under foot.

On the 8th of November, the Montreal Branch celebrated its 25th anniversary, in the Natural History Society's Rooms, University Street. On this occasion eminent entomologists from London, Toronto, Ottawa and and other places were present. The Quebec Association was represented by its president, who was specially deputed by its members to convey their congratulations to their Montreal *confreres*.

It is gratifying to see the spread of interest in Entomological pursuits. The past year has been marked by the formation of "The North West Entomological Society." It numbers among its members the Right Reverend the Bishop of Calgary and Saskatchewan; John A. Simpson, M.L.A.; A. G. Wolly Dod, Esq., Secretary of the Fish Creek Agricultural Society; Dr. H. George, Vice-President of the Innisfail Agricultural Society; Wm. Posthill, Esq., J.P., Vice-President of the Red Deer Agricultural Society; John Y. Young, Esq., editor of the "Calgary Herald". The membership of this society exceeds forty already.

It is to be hoped that our own association will continue to flourish and will spread information concerning our insect friends and insect foes, and the right method of dealing with both. One of our leading botanists, while seeking to advance agricultural interests. truly said: "A good knowledge of Entomology is good for the farmer—*There is money in it.*"

Report of Council.

Your Council has pride in producing this report for the approval of the branch as we have nothing but pleasure to note as to its working.

The branch now includes forty-two members; 28 adults and 14 juniors. The Treasurer's report gives a most satisfactory showing.

Several excursions were made, and the capture of many specimens—some of them rare—has rewarded the efforts of the members. As was remarked in a former report these excursions tend to bring about a good feeling of comradeship and are beneficial in every way. The younger members of our branch have been extremely keen in hunting for and acquiring specimens and their efforts have been highly successful.

The largely increasing membership affords much reason for congratulation.

Our thanks are due to the authorities of Morrin College for their kindness in placing a room at the disposal of the branch for its meetings.

Joseph Eveleigh Treffry,
on behalf of the Council.

The following officers were elected:

President, Rev. Thomas W. Fyles, D. C. L.; *Vice-President*, Miss Macdonald; *Council*, Hon. Richard Turner, Mr. J. Eveleigh Treffry, Prof. H. Walters, Mrs. R. Turner, Miss Bickell, Miss B. Winfield; *Secretary-Treasurer*, Lt. Col. Crawford Lindsay; *Curator*, Prof. H. Walters.

Since the annual meeting in April the Branch has held four regular meetings and four field days.

The Branch now numbers thirty-two adults and fifteen junior members.

Crawford Lindsay,
Secretary-Treasurer.

Quebec, October 7th, 1899.

REPORT FROM THE ENTOMOLOGICAL SOCIETY FO ONTARIO TO THE ROYAL SOCIETY OF CANADA.

By Rev. Thomas W. Fyles, D.C.L., F.L.S., Delegate.

The Entomological Society of Ontario held its 35th annual meeting in Montreal on the 8th and 9th days of November last. The Society is gaining ground—is lengthening its cords and strengthening its stakes, or, to use another figure, is rooting itself more firmly in public estimation, while its ramifications are vigorous and fruitful.

Originated in 1863, through the efforts of a very few earnest men, who were impressed with a sense of the practical value of Entomological pursuits, the Society has

steadily progressed till it has attained a degree of importance that insures for it the respect of scientific men "all the wide world over." Its publications are now circulated in 22 countries, in the four quarters of the world. On this continent, not only are they distributed throughout our own dominion, they are sent also to no less than 40 of the states and territories of the great Republic to the south of us.

At 429 Wellington Street, London, Ont., the Society has its headquarters—a large, convenient and well appointed room, with a valuable library of 1,600 volumes, and cabinets containing many thousands of choice specimens, contributed by its members or obtained by purchase or donation. Among its treasures are special collections, such as the Pettit collection of Coleoptera, the Loomis collection of Japanese butterflies, the Moffat collection of Canadian Lepidoptera, acquisitions gained through years of research by skilful, scientific men.

The Society's librarian and curator is Mr. J. Alston Moffat, a man devoted to his work, well acquainted with the objects under his care, and most kind and obliging to those who seek information from him. The room is open at all convenient hours; and an examination of its contents will well repay the naturalist who will take the time to visit it.

The various sections of the Society are working zealously. The Botanical section reports the discovery of three plants new to the district of London. It also draws attention to a species of wild lettuce (*Lactuca scævola*) that is rapidly spreading, and becoming troublesome to the agriculturists of Middlesex County, and to a species of dodder (*Cuscuta epithymum*) that flourishes upon clover. The Microscopical section has held 9 meetings in the course of the year. Papers on "Shine Moulds," Bacteria, Radiolaria, Diatoms, and Marine Algae, were read before it. The Geological section met weekly throughout the year. Its report describes the bituminous shales of Kettle Point, the "Crystal Cave" at Put-in-Bay, and the strontium found in it. The Alvinston shales; the dolomite rocks at Galt, and the new oil-field in Sarnia Township.

Notes on the "Insects of the Year" have been sent in by the Society's divisional directors:—Messrs. W. Hague Harrington, Ottawa; J. D. Evans, Trenton; Arthur Gibson, Toronto; A. H. Kilman, Ridgway; R. W. Rennie, London. These notes appear in the Society's annual report.

Flourishing branches of the Society exist in Toronto, Montreal, and Quebec. That of Montreal is particularly deserving of notice, forasmuch as it has recently celebrated the 25th anniversary of its formation. To do honor to the occasion the parent society held its annual meeting in Montreal, and the Natural History Society and the Microscopical Society of that city gave their aid and support. The proceedings were of a most interesting and enjoyable character.

The Society's monthly organ, "The Canadian Entomologist," completed its 30th volume in December last. In this volume articles from 53 contributors may be found. Some of the authors wrote from such distant places as Cape Town, Africa; Hildesheim, Germany; Mesilla, New Mexico; Massett, Queen Charlotte Islands. The volume contains, amongst other important matter, descriptions of 35 new genera, and 190 new species of insects, and it is illustrated with six plates, one of which is beautifully coloured. Among the more important articles are:—

A generic revision of the Lachneidæ, by Harrison G. Dyar, Washington, D.C.

On the history and habits of the "Wood Engraver" Ambrosia Beetle, by A. D. Hopkins, Entomologist, West Virginia Agricultural Station.

The Coleoptera of Canada, by H. F. Wickham, Iowa City.

"New and little known bees," by T. D. A. Cockerell, N. M. Experiment Station.

"Some Indiana Acridiidæ," by W. S. Blatchley, Indianapolis, Ind.

"New species of Chionaspis, and notes on previously known species," by R. A. Cooley, B. S., Amherst, Mass.

"New species of North American Myrmelionidæ," by Rolla P. Currie, Washington, D. C.

"Metallic species of Basilodes and new species of allied genera," by R. Ottolengui, New York.

"Descriptions of new genera and species of the Geometrina of North America," by Geo. D. Hulst, Brooklyn, New York.

"Notes on some Ontario Acridiidæ," by E. M. Walker, Toronto.

"Classification of the Horntails and Saw-flies, or the sub-order Phytophaga," by William H. Ashmead, assistant curator Dep. of Insects, U. S. National Museum.

"Additions to my Synopsis of the Tachinidæ," by D. W. Coquillett, Washington, D. C.

The twenty-ninth annual report of the Society "(published by the Ontario Department of Agriculture, Toronto), printed by order of the Legislative Assembly of Ontario," has just been issued. It is embellished with portraits of William Hague Harrington, F. R. S. C., president of the Entomological Society of Ontario, 1893–5, and John Dearness, I. P. S., president of the Entomological Society of Ontario, 1895–7, and also with 67 figures of insects. It contains a full account of the annual meeting, reports from the officers and the various divisions and branches of the Society, the President's address, articles entitled :

"Some economic features of International Entomology," by F. M. Webster.

"The farmer's garden and its insect foes," by the Rev. Thomas W. Fyles.

"Entomology in schools," by Wm. Lochhead, Ont. Agr. College, Guelph.

"Injurious insects in 1898," by Dr. James Fletcher, Ottawa.

And a number of short papers of great value.

In the president's address attention is drawn to some remarkable experiments, of interest to biologists, made by Mr. Henry E. Crampton, jr., of the Department of Zoology of Columbia University. Mr. Crampton succeeded, in a number of instances, in grafting one insect in the pupal stage upon another in the same condition. For instance, he cut off the head portion of one chrysalis and several segments of the abdomen from another, and then joined the main portions of the two by means of a ring of paraffin. Coalascence was completed and, after a time, a living, eight-winged monstrosity was produced.

The disposition evinced by some, in the present day, to tamper unnecessarily with the nomenclature and classification of insects, now accepted, is also spoken of. Our systems are not perfect, but the day for a thorough revision of them has not yet come, and will not till the life histories of the various species, and the literature respecting them are better known. The late Dr. Lintner did excellent work in tracing such histories, and in heading his remarks with names and synonyms and references to authors. His work in these respects as in others is a model for entomologists.

In connection with this subject, the paper by Mr. Dwight Brainerd, in this same report, on "The preparation of specimens for the exhibition of life histories in the cabinet" will be found valuable. The plate that accompanies it shows groups of insects in all stages. There are the eggs, the larva, the pupa, the perfect insects (both types and varieties), the wings denuded of scales to show the venation, and the parasites that assail the species. From an educational point of view, a complete collection on Mr. Brainerd's plan would indeed be accounted a treasure. The article is the more valuable because the author describes his methods of preparing specimens for the cabinet.

Another important paper in the report is Prof. Wm. Lochhead's "Entomology in the Schools", showing *Why? How? and When?* the subject should be brought before the rising generation.

It is hoped that sufficient has been said to show that the society's publications are of value. Prepared chiefly for the agricultural community, its reports deal largely with troublesome insects and the methods of destroying them ; but the beautiful and beneficial species are not overlooked in them ; and even, as regards the less attractive kinds, so much that is wonderful in their structure and life histories is made known to us—so clearly is it shown that through and beyond the trouble they may give to man, destructive insects have important parts to play in the economy of nature, that our admiration is excited, and we feel the truth so quaintly expressed by the Rev. George Herbert :

"Nothing we see but means our good,
As our delight, or as our treasure ;
The whole is either our cupboard of food
Or cabinet of pleasure.

THE NATIVE HOME OF THE SAN JOSE SCALE.

By F. M. Webster, Wooster, O.

In the July, 1898, number of the Canadian Entomologist, I published a short discussion on this subject, giving the results of some, then recent, examinations of nursery stock, coming directly from Japan. I there also referred to a short note by Prof. T.D.A. Cockerell, in Entomological News, Vol 9, pages 95 and 96, to the effect that Mr. Alexander Craw, Quarantine officer at San Francisco, California, had two or three times found this insect on trees from Japan, and notably on a plum tree that arrived Jan. 25th, 1898. After this note of mine had been published, Mr. F. A. Sirine, one of the entomologists of the New York Experiment Station, located at Jamaica, N.Y., wrote me that there was some pretty good evidence in his possession indicating that the San José Scale had been established on Long Island a much greater length of time than was supposed; that its occurrence there possibly antedated its appearance in New Jersey. When I prepared my paper for the 1898 meeting of the Entomological Society of Ontario, entitled "Some International Problems in Applied Entomology," and, on again going over my notes, it appeared to me that, with the amount of material in my possession and its appearance, I had sufficient evidence not only to verify all that had been stated or written, but that I had almost the conclusive evidence wanted to prove that Japan was the original home of the scale, and that it was, as with the Gypsy moth, being kept reduced and in subjection by its natural enemies. I did not, at the time, have in my possession a paper published in the June, 1898, Massachusetts Crop Report by Mr. A. H. Kirkland, in which he makes the following statements:

"While it is generally conceded that 1887 marks the date of the first importation of the scale to the east, a case has recently come to the writer's attention that would indicate the possibility of the occurrence of the San José Scale in a Long Island nursery at a date somewhat earlier than that of the New Jersey infestation, and possibly as a result of the direct importation of trees from Japan. The facts are these:

In the vicinity of Boston there is an educational institution where particular attention is given to the study of trees and shrubs. On the grounds of this institution, there is a colony of the San Jose Scale which is confined in great measure to a plot of perhaps thirty Japanese quince bushes. These bushes, according to the testimony of those in charge of the grounds, "have been infested for many years." Careful records of all trees planted are kept by the authorities of the institution, and in this case the records show that the bushes in question were purchased from three sources: the firm of James Veitch & Sons, London, England, in 1881; Louis Spath, Rixdorf, Berlin, Germany, in 1888; and the Parsons & Sons Company, Flushing, Long Island, in 1884. The greater part of the bushes were obtained from the latter source, and these are infested to the greatest extent, although the scale occurs on all of them. The infestation of this nursery for many years past is a matter of common knowledge among entomologists and nurserymen; also the fact that this nursery has paid especial attention to the importation and distribution of Japanese stock. Unfortunately, all these Japanese quinces were grown for one season in a very compact plot and their infestation is so general that it is impossible to decide which were the ones originally infested. From an inspection of the grounds, it is evident that these bushes are the centre of infestation in this colony; and, unless it is shown that the English and German nurseries are infested, of which there is no evidence at present, the natural inference is that the Long Island nursery is the source from which the infested stock was obtained, thus antedating the New Jersey occurrence by about three years. Again, the conclusion that the Long Island stock was the source of the scale at this particular locality may be placed the length of time elapsing since its purchase,—some fourteen years. The time required for the killing of trees by the scale is placed by Messrs. Howard and Marlatt at from two to three years. In the south, where the active season of the insect is longer than it is here, and the warmer climate more favorable to its multiplication, undoubtedly this may be the case. It is also prob-

able that a longer time is required for the destruction of trees from this cause in this region; for we have records of an apple orchard at Scituate, Mass., planted in 1892 with infested trees two or three years old, of which about 90 per cent., although very badly affected, were alive in 1897, at which time remedial measures were applied. Since a Japanese quince with vigorous roots will throw out an abundance of new shoots year after year as the old wood dies off, the continued infestation since 1884 of the bushes previously mentioned does not seem beyond the limits of possibility."

Quite recently, some exceptions have been taken to the statement that I made in my paper last year, presented to the Entomological Society of Ontario, in which I used these words, "I have been able to prove almost conclusively that Japan is the original home of the San Jose Scale." The arguments against this are that Mr. Koebele and some of the Japanese entomologists searched for San Jose Scale in Japan, but did not find it. If this means anything at all, it might mean that the scale was present but kept thoroughly in subjection by its natural enemies, and perhaps some other resistent elements of which we are, as yet, unacquainted. Another argument is that the scale may have been introduced into Japan, from California, and was now, for the first time, being received back again from that country. At present, we have no record of any very old introductions of nursery stock from California into Japan, and if there were, it would be difficult to prove, or even to show evidence that these were infested with the San Jose Scale. The nursery stock that I have myself examined came direct from Japan, and gave every possible indication of its having been quite numerous where the stock was grown; and the occurrence differed very materially in appearance from the ordinary occurrence upon nursery stock, as witnessed in this country. Up to the present time, I see no reason whatever for modifying the statements that I have made. I do not claim that there is, as yet, conclusive proof that the scale came to us originally from Japan, but that the evidence points almost conclusively in that direction, I feel as confident as I did when I prepared my previous statements. Of course, there is nothing left to do but trust to time and future investigations to solve the problem. Entomologists in Japan can certainly throw a great deal of light upon this problem, and if the question can be settled, finally, either in the affirmative or negative, I shall be entirely satisfied. I do not care a straw whether the San Jose Scale is, originally, a native of Japan or not, but I do care a great deal as an entomologist, to know just the fact in the case, not as a matter of self-interest but as a scientific fact.

SOME NOTES ON THE LARVAL HABITS OF THE GRAY HAIR-STREAK BUTTERFLY.

(*Uranotes melinus*, Hubn.)

By F. M. Webster, Wooster, Ohio.

The larvæ of the Gray Hair-streak have long been known to injure beans by eating their way into the pods and devouring the young growing beans therein. In Insect Life, Vol. VII, p. 354, the statement is made that these larvæ, though long known as injurious to the hop, had also been known to injure young beans in New Jersey, District of of Columbia and California.

On July 3, 1899, a correspondent of mine, Mr. Henry Hurd, Carthagenia, Ohio, sent me a pea pod in which he had found a worm of some sort, eating the peas. The pod reached me in good condition, and clearly indicated the seriousness of the attack, but the depredator had eaten out of the box and through the wrapper, and doubtless was lost in the mail sack. On July 10, Mr. Hurd sent a second larva, which reached me alive, but it never developed. Mr. Hurd stated the first one sent, ate three grown peas and gnawed into a second pod within the space of a few minutes.

On July 7, the Station janitor brought me some larvæ which he stated were eating into the pods of his garden beans. These larvæ were placed on a hill of beans and covered with a breeding cage. On August 8, a single adult *Uranotes (Thecla) melinus*, Hübn, was found dead in the cage.

On August 14, a correspondent, Mr. Fred. Ruth, Clifford, Ohio, sent two larvæ which he had found in the silk in the tips of the ears of corn in the field. As he had found adults of *Diabrotica longicornis* in the same situation, Mr. Ruth supposed that they were the adult insect from these larvæ. As soon as they were received they were at once recognized and placed upon young bean pods, upon which they at once began to feed. On August 22, both pupated, and from one of these pupæ an adult issued on September 1, while the other has up to this date, October 4, remained undeveloped.*

While we lost the first larva sent by Mr. Hurd, the second was recognized, and if it was not of the species under consideration, it certainly belonged to a species closely allied to this. Thus we have the pea as a probably new food plant, and the silk of corn on the ear as an undoubted additional new food plant for the species, and certainly rather a unique locality for the larvæ to be found in.

According to the article referred to in the beginning, which by the way is illustrated, the habitat of the species is given as Canada (rarely); and south to Indian River, Florida, and quite to the Mexican border, Mexico, Central America, Venezuela and the Antilles. The present is the first year that my attention has ever been called to the work of the larvæ.

SAN JOSE SCALE.

The meeting was called to order at 2.30 o'clock, the Vice-President, Rev. Dr. Fyles, occupying the chair. After a number of papers (which are given in subsequent pages of this report) had been read and discussed, the consideration of the San Jose Scale insect was again taken up. The Secretary reported that the Special Committee had been unable to arrange any time for a meeting. Mr. Dearness said that as the whole of the previous afternoon had been spent in a conference upon this insect, it would be a pity if no action were taken by the Society; he accordingly moved that the meeting be considered as a committee of the whole, which was adopted.

At the request of the members present Mr. Dearness read a synopsis of the report of the Commissioners appointed by the Hon. the Minister of Agriculture to investigate the San Jose Scale last summer, and explained various points in connection with it.

Dr. Fletcher said that one of the great difficulties in the way of carrying out the recommendations of the Commissioners was the liability of the orchard owners to evade the law as far as possible, and to neglect the means recommended for checking the pest. The feature of the report which would probably be most objected to was the boarding of the men sent by the Government to perform the work, but this might be overcome by sending them to the nearest hotel for the short time that they would be in the neighbourhood. He thought that the Minister of Agriculture had acted very wisely throughout this matter, and that great care had been exercised in the selection of inspectors; if any were found inefficient their services were at once dispensed with.

After some further discussion the following resolution, moved by Dr. Fletcher and seconded by Dr. Bethune, was unanimously adopted:

"This Society has watched with keen interest and wishes to express its hearty approval of the measures adopted by the Hon. the Minister of Agriculture and Arts for Ontario for the suppression of the San Jose Scale, and the wise and judicious manner in which he has endeavoured to carry them out."

* From this pupa the butterfly emerged on January 4th, 1900, thus shewing that of two larvæ, probably from the same brood and same mother, one may develop to the adult in September, and the other go over until the following spring.—F.M.W.

Several other papers were read and discussed, including the reports of the Directors on the noteworthy insects of the year in their respective divisions.

Dr. Fletcher exhibited some rare or otherwise interesting specimens, several of which he presented to the Society.

Hemileuca Maia var *Lucina.* This is the form of the species which occurs in Manitoba, the specimens presented had been taken by Mr. Norman Criddle, at Aweme, in Manitoba. In July, 1898, Dr. Fletcher had taken two nearly full grown larvae feeding on aspen at Bird's Hill a few miles from Winnipeg, and had bred the moths the same autumn. Variety *Lucina* differs from the species in the much greater area of white on the wings.

Colias Emilia—A fine pair presented which had been taken by Mr. C. de B. Green at Osoyoos. The eggs of this species are laid on *Astragalus frigidus.* It is a larger species than *Colias Christina*, some forms of which it resembles, particularly in the female sex. The eggs of *C Christina* Dr. Fletcher had seen deposited by the females on *Salix desertorum* at Olds, N.W.T.

Colias Edwardsii exhibited, which had been collected and seen in some numbers at Arcola, Glen Adelaide, Clare, Alameda, Carnduff and Gainsboro, in the south eastern part of the N.W.T. Females were seen ovipositing and eggs were collected on the Prairie Bean, *Thermopsis rhombifolia.* This species resembles closely *C. Alexandra*, but is smaller and has the margins partly fringed with pink.

Pamphila Manitoba, var *Assiniboia*, specimens of both sexes presented which had been taken at Regina in 1886.

Chrysophanus Helloides, var *Florus* (female) presented, taken at Vernon, B.C.

Argynnis Chariclea presented, taken at Mount Cheam, B.C.

Coenonympha inornata, presented, taken in large numbers in the N.W.T. this year.

Vanessa Californica, presented, one of the first specimens taken in Canada, caught in Victoria, B.C., 1885.

Carterocephalus Mandan, presented, a large form taken at Laggan in the Rocky Mountains which has been written about in the Canadian Entomologist by Mr. T. E. Bean in 1893 as *C. Palæmon.*

Lyda multisignata, a new pest of the raspberry. The specimens presented were bred from larvae, which had been sent from St. John, N.B., where they had been injurious for three years.

Crioceris asparagi and *C. 12-punctata*, the two asparagus beetles; first recorded as injuring asparagus in Canada this year. Both forms were abundant at Queenstown and other places in the Niagara peninsula.

Gonioctena pallida, specimens were presented. This beetle has been very abundant in many parts of the Northwest and Manitoba for three seasons. Aspen poplars have been entirely defoliated over large areas. They were less numerous last summer.

The following were exhibited :—

Lepisesia ulalume, a very rare species representing on the Pacific coast the eastern *L. flavofasciata.* The specimens were taken at New Westminster by Mr. Dashwood-Jones. The flight of *L. flavofasciata* was described and its close resemblance to a bumble bee when flying referred to.

Thecla strigosa bred from larvae found attacking green plums by Mr. W. M. Orr. at Fruitland, Ont.

Thecla Iroides, bred from larvae eating green apples at B.C., found by Mr. E. A. Carew-Gibson. The habit of boring into their food had also been noticed with the young larvae of *Thecla Niphon* which feeds on the young shoots of white pine.

Erebia Epipsodea. This species had been bred again this year from eggs received from Mr. N. B. Sanson, of Banff, Alta. There were only three moults as had been

previously recorded by Mr. Lyman, but the mode of pupation was slightly different from that described by Messrs. Lyman and W. H. Edwards, the chrysalis being surrounded by several spans of silk in the same way as had been observed by the speaker in the case of *E. Discoidalis*. *E. Epipsodea* is an abundant species on the prairie from the western borders of Manitoba through the Rocky Mountains to the interior plateau of British Columbia. It was seen in hundreds on the prairies in the early part of last July.

Heliothis armiger. A specimen bred from a green larva found feeding upon geraniums in a greenhouse, late in the autumn of 1898, the moth of which had emerged in the summer of 1899.

Chinobas Macounii, eggs were shown which were laid by a female among the thorns on the dead twigs of a wild rose, at Nepigon. The bush was standing in full sunlight on a sandy bank and no plant of Carex or grass could be found within 10 feet. The female was seen to lay three eggs all on the dead twigs. These hatched in the ordinary time of 15 days.

Chrysophanus Thoe. Full grown living larvæ were shown, reared from eggs laid in confinement late in August. Of about 40 eggs half had hatched, but in nature it was thought by the speaker that as a rule the eggs did not hatch until the following spring. He had discovered that the females laid their eggs not on the seed pods of the dock, as had been previously thought, but low down on the root leaves and at the base of the stem, where they would be covered up with snow during the winter. Many eggs were found on plants growing in the water, and within an inch of the surface. The larvæ during the three moults, as well as the beautiful green and pink pupæ, were shown, also brown pupæ and a dipterous parasite (*Exorista confinis*). Larvæ and eggs had been found on *Rumex orbiculatus*, but larvæ fed readily on all docks offered except *Rumex obtusifolius*.

A beautiful collection of inflated larvæ, prepared by Mr. C. H. Young, of Ottawa, was exhibited, and, the value of this method of preserving a permanent record of larvæ for study was urged. Mr. Arthur Gibson, Assistant in the Division of Entomology, had also prepared some nice specimens, which were exhibited.

Lycæna Anna—A fine series of this rare species was exhibited with the larvæ and pupæ. Almost full grown larvæ had been found on the 8th of August last at a height of 7,000 feet on Mount Che-am, B. C. The larvæ are green, and feed on the leaves of lupins. The interesting discovery was made that the larvæ when full grown crawl down the stem and burrow down to pupate, from an inch to two inches beneath the surface of the ground, as a rule following the stem and remaining attached to it. Five females and three males were exhibited. These showed considerable difference in the markings of the lower side.

Benacus griseus—A specimen of this large water-bug, taken at Toronto, was shown, and the difference between this species and *Belostoma Americana* pointed out. The members were asked to examine all large water-bugs seen beneath electric lights, so that the range of the two species might be ascertained. Although sought for carefully at Ottawa, *Benacus* had never been detected there. In *Benacus* there is no deep groove down the middle of the cushion-like area on the front raptorial claws.

The Pea Aphis, *Nectarophora destructor* Jnsn. (n. sp) Specimens of the Destructive Pea Aphis, together with three parasites, were shown, and a statement made as to the injuries inflicted by this pest during the past summer. Colonies had appeared in various places from the Maritime Provinces to the western portions of Ontario.

On motion of Mr. W. E. Saunders, seconded by Mr. Balkwill, it was resolved that the thanks of the Society are due and are hereby offered to Dr. Fletcher for his kindness this year, and on many previous occasions, in presenting a number of valuable insects to the Society's collection.

The meeting adjourned at 4.30 p.m. in order to enable the members from a distance to catch their respective trains. It was the unanimous opinion of all present that this was the most useful, interesting, and also entertaining, meeting that the Society has ever held.

NOTES ON SOME INSECTS OF CONIFEROUS SHADE TREES.

By Prof. W. Lochhead, Ontario Agricultural College, Guelph.

Chermes Abietis (Spruce Gall Louse). Many complaints were made in May about an insect which was attacking spruce trees. The terminal, young shoots were first attacked, then the immature leaves of the buds became enlarged at their base, and the tissues were gradually killed, so that the twigs curled up and died. Conspicuous woolly secretions were observed on the leaves of the spruce about the first week in May. These secretions enveloped masses of yellowish eggs (200 to 300 in number). About a week later the eggs hatched, and the young lice moved to the bases of the young leaves of the shoots, when enlargements began to form. A fine spruce hedge at the Agricultural College was infested so badly that it was feared that the fine trees would be permanently disfigured, and even destroyed. An examination of the new leaves revealed a louse at the base of nearly every new leaf, and the deformation of the twig were becoming quite evident. A later examination showed the presence of several fat syrphus larvæ, which had taken up their quarters at the bases of the leaves, and were feeding quite greedily on the lice. Many other buds were examined from different parts of the hedge, and in every case syrphus larvæ were found. To spray this tall hedge with whale oil soap and tobacco solution appeared a gigantic task, and to clip off the infested twigs was not to be thought of, as such an operation would be a life's task. Just at this juncture, when there seemed no other expedient but to leave the control of the lice to the syrphids, Dr. Howard, of Washington, who had been consulted in the matter, wrote as follows:

Fig. 8. Spruce Gall Louse. (*a*) Summer form of nymph. (*b*) A sprig of White Spruce, with one twig affected by galls produced by the young lice.

"Your best hope of relief seems to be in the probable ultimate appearance of some parasitic or predaceous enemy; and, when the gall louse is as abundant as you describe, I think relief in this direction will shortly be forthcoming."

Accordingly the lice were left to the tender mercies of the syrphids.

Observations during the remainder of the season were made rather intermittently on account of absence from College for several weeks; but, on August 19th, another examination of the galls and twigs was made. Woolly secretions were again observed which contained masses of eggs (30 to 40 in number). A few adult winged forms and many young lice were seen but in numbers not to be compared with those seen in May. Many syrphus larvæ were again found. On August 31st some of the infested twigs were again examined, but there were very few lice, no eggs and no adults, while the syrphids were quite numerous, and occupied tunnels in the leaf bases between the galls.

That Nature has done her work well, it is sufficient to state that the hedge never looked better than at present. Later shoots have appeared, and a stranger could scarcely tell that an insidious pest had started to work there in the spring.

Professors Fernald and Cooley, of Amherst, issued a bulletin on *Chermes abietis* during the winter. As the observations of the life-history of the Spruce Gall Louse at Guelph correspond very closely with those of Fernald and Cooley, a synopsis of the life-history is here given :

Summer Brood :

1.—In early spring—white woolly mass containing about 300 eggs, on new shoots.

2.—Eggs hatch in about one week, and nymphs settle in bases of young shoots.

3.—Three moults ; antennae of 3 segments.

4.—About Aug. 10, winged adults—females—appear, antennae of 5 segments.

5.—Two days later eggs (40) are laid covered with a woolly secretion near tip of leaf.

6.—Eggs hatch in two weeks.

Winter Brood :

7.—Nymphs, antennae of 3 segments, spread over limbs near by, some attaching themselves to leaves, some at axils.

8.—Pass winter at base of buds, nearly all killed.

9.—About April 20, moulting begins, and nymphs grow very rapidly, secreting a copious woolly coating.

10.—Eggs are laid about May 1–10, and females soon die.

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1869. Packard—Guide to the Study of Insects—p. 522.

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1888. Comstock—Introduction to Entomology—p. 160.

1890. Packard—Forest Insects—p. 853.

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1898. Fernald and Cooley—The Spruce Gall-Louse.

Lygæonematus (Nematus) Erichsonii (Larch Saw Fly.) On June 1st many adult females were observed ovipositing on the underside of the stems of the terminal shoots of the larch or tamarack.

During oviposition the female hangs head downwards, and the eggs are laid in incisions on the under side of the axis of the terminal shoots. (Fig. 9, *c.*).

The slits in which the eggs were placed very closely were made in two rows. The eggs were of a glassy white color and spindle-shaped.

On June 5th but few females were found. The axis of the shoots on which the eggs had been laid were turning brown, and were bending, owing to the death of the tissues in the region of the slits.

Three days later (June 8th) minute larvæ varying from $\frac{1}{4}$ to $\frac{1}{3}$ of an inch in length were found. Their heads and the six true legs were shining jet-black. The larvæ have the habit of curling their tails over their backs whenever disturbed.

Fig. 9. Larch Saw-Fly. (*a*), the saw-fly with wings outspread; (*b*), the brown pupa case; (*c*) terminal twig of larch showing eggs in slits made by the female saw-fly.

On June 10th the larch grove was sprayed with Paris Green ($\frac{1}{2}$ lb. to the barrel), but as this solution was rather weak, and as many of the trees towards the centre of the grove could not be thoroughly sprayed, or even sprayed at all, the trees were found to be still infested three weeks later.

The larvae grow rapidly, and at maturity are nearly one inch in length. The defoliation of the larger trees near the centre of the grove was almost complete.

On July 20th no larvae could be found; those that had survived the Paris Green had descended to the ground, and pupated. The oval, spindle-shaped pupæ (Fig. 9 *b*) could be found quite abundantly under the trees among the litter of leaves. These remain in the ground all winter, and the adults will emerge about the end of May.

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Lyda sp.; (Colorado Spruce Saw-Fly.) On May 30th several black saw-flies were observed resting on the leaves of an ornamental spruce, the Colorado spruce (Picea fulgens), on the College grounds. These saw-flies had a wing expanse of one inch and a quarter, while the body was nearly three-quarters of an inch in length. On several of the branches were large masses of castings which were over two inches in diameter. These masses of castings were never situated at the ends of the branches, but about midway on the branches. The leaves in the neighborhood of the castings had been eaten by the large greenish-black larvæ which occupied silk-lined tunnels within the mass. (Fig. 10.)

FIG 10.

No eggs could be found at the time the adults were seen. A good spraying of Paris Green was given, since which operation no larvæ have been found. It is evident that the Lyda saw fly is a very destructive insect to this spruce, and should conditions ever arise when the larvæ were numerous, the damage would be very considerable

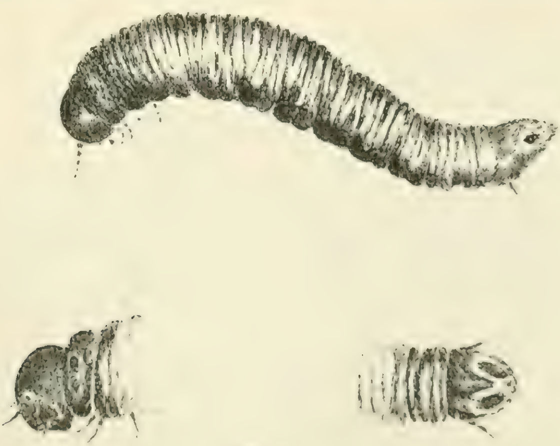

FIG. 11.

The adults are larger than the adults of the larch saw-fly. Their abdomen is depressed and flattened. Their front wings are about as long as the thorax and abdomen

together, and across the middle of each wing is a cloudy band. Their feelers or antennae, composed of many joints, are long and setaceous.

Their legs are light yellow in color, as are also the basal joints of the antennae and the mandibles. The tarsi of all the legs have five segments.

The caterpillars (Fig. 11) when full-grown are about an inch and quarter long. The head, the dorsal portion of the first segment of the thorax, and under surface of the whole thorax are black. The body is dull olive-green in color, and very much wrinkled. There is a prominent zig-zag lateral line on each side at the junction of sternite and pleurite. There is also a prominent V-shaped ridge on the upper surface of last segment, and the depressed areas between this ridge and the elevated lateral ridge are black, as is also the lower surface of the last segment. The antennae are short and 7-jointed; the last pair of legs are 3-jointed.

Curiously enough the larva corresponds very closely with an undetermined larva, figured and described by Packard in his *Forest Insects*, page 852. Dr. Packard does not appear to have seen the adult.

THE ELECTRIC LIGHT AS AN ATTRACTION TO MOTHS.

By Arthur Gibson, Assistant-Entomologist, Central Experimental Farm, Ottawa.

A good deal has been written of late years on the many beautiful and rare moths which have been captured while collecting around the electric lights of cities and towns. The attraction that these lights have for moths, especially in situations on the outskirts of a locality, is really astonishing, and the number of different species secured in a single season from a few visits to these lights is very considerable. Much useful work can in this way be accomplished, and many species which are seldom met with otherwise are quite often taken at the electric lights.

On warm, close, rainy-like nights especially, particularly in the month of June, swarms of insects of almost all kinds congregate around the electric lights, varying in size from the large Attacus Cecropia emperor moth, down to the tiniest of species. On cool, raw nights also moths are to be found fluttering around the lights, these conditions seemingly making little difference to them, and on nights when it is even pouring rain many species of moths are observable. Even this does not apparently lessen the attraction which the electric lights have for these insects, and on a visit on almost any night during the collecting season, moths of some kind are sure to be found.

I have often noticed and wondered at the abundance of males, and the scarcity of females around the electric lights. I have taken many males, of numbers of species, but have yet to take females of these, and even amongst our commonest species the males predominate to a large extent. Of course, it must be remembered that the females do not move around or fly such distances as the males do, generally staying near their food plant on which they lay their eggs. The males, on the other hand, being much stronger fly quite long distances, no doubt one reason being their endeavor to search for and locate the females, and in this way they come in contact more readily with the electric lights. Unless, therefore, the electric lights are so situated as to be in close proximity to the food plants, near where the females have emerged, it is likely that the collector would find but few of them. This may be one, and an important, reason for the scarcity of the females around the electric lights.

Many moths have a habit of circling around the electric light, and in a short time alighting on the telegraph pole, where, in numerous cases, they generally rest a long time, in fact, often until daybreak, and I have even found them there at all hours of the day. Specimens which have alighted on the poles are, of course, mostly easily captured, but those which circle round for half an hour, and even longer, tend considerably to try the collector's patience, but in the end he is often rewarded by either netting the specimen after it has circled lower, or else capturing it when with a sudden dart it descends,

striking the ground. Quickness, however, is needed in the latter case, as quite frequently the specimen ascends again with as much rapidity as it descended. Sphingidae are particularly quick in this respect, and the collector has to be on the alert, and capture the specimen as soon as it descends, On the other hand, numbers of other moths are quite within reach and easy to catch, as they fly anywhere within the rays of the electric lights, not always flying close to the globe. Geometers are especially noticeable in this regard, and can be taken without much trouble. The large emperor moths have a habit of flapping near the ground, and are then generally easily caught.

The brilliant illumination from the arc lights seems to have a dazzling effect on many species, as after fluttering around for a time they often seek the dark, or shady, side of the telegraph pole, where they are often found resting. This I have noticed among many of the sphingidae, and more often among the arctiidae, the tiger moths being especially conspicuous in this respect. Many of the noctuids also are apparently dazzled, and hide from the light.

I have found that where another pole is within a few feet of the pole, from which the electric light is suspended, numbers of "good things" seek a resting place thereon, and these are generally within easy capture. Those out of reach I have often dislodged by throwing up a piece of sod, or else a handful of caked mud. Some collectors use long rods with a net on the end for this purpose, but for my part I have found this a needless trouble, and the appliance is not always easy to handle, and it is difficult and often impossible to place the net just where it is wanted. In Ottawa the electric light poles have iron attachments, which are used by the electric linemen to climb the poles when the carbons require replacing in the globes, or the lamps repairing. It is therefore not much trouble for us to secure specimens which are resting on the poles. In Toronto, where I collected for a number of years, the globes have all to be lowered by the linemen for repairs, etc., and the poles do not have these iron attachments, consequently we had to devise other means whereby to secure the specimens. We first of all tried these long rods with the net on the end, and of course, with this aid secured many moths, but on the other hand many were still out of reach, so we afterwards discarded the long rods and generally secured any specimens we desired by simply throwing a piece of old sod, or caked mud at the moths, dislodging them from their place of rest, when they generally fell to the ground and were quickly bottled. At the entrance to the Experimental Farm at Ottawa is one of the best electric lights that I have ever collected at; within a few feet of this stands a telegraph pole, and during the past summer we took quite a large number of beautiful and rare moths while they were resting upon this pole, a much larger number of specimens being taken off this pole than off the one from which the light is suspended.

The best hours I have experienced for collecting at electric light are from 9 o'clock to about half past 10 o'clock, and after 12 o'clock to about 2 o'clock. I have never stayed later than this but I have been told by collectors who have stopped around the lights all night, that they took very few specimens after the latter hour. The earlier part of the evening until half past 10 o'clock or so seems to be the most productive.

If the collector is interested in breeding moths from the egg to the imago, the electric light furnishes a great help toward this end, as when a female is captured if it is desirable to obtain eggs, all that is necessary to do is to enclose her in a box, when she will, as a rule, deposit at least a portion of her eggs, provided she has not laid them before capture. I have often secured specimens in this way and had the pleasure of breeding the specimens to maturity. As an example I might cite that during the past summer I took a female of Euprepia caja, while collecting at the electric light, putting her in a box alive where she remained the whole night. By the next morning she had laid nine eggs, five of which hatched. I have succeeded in getting two of these larvæ past the sixth moult, and both, on the 9th inst. started to spin a slight cocoon. This occurrence is very remarkable as the larvæ of Euprepia caja are known to hibernate through the winter, but the reason mine have passed through all their stages and spun a cocoon, is probably no doubt due to the fact that they were kept very clean in doors and given

fresh food plant generally twice a day. I have taken descriptions of the different stages and will probably later on publish my notes in the Canadian Entomologist. Dr. Packard in his "Study of Insects" says that the larvæ of Euprepia caja moult from five to ten times. At the electric light females of moths are thus secured which might be hard to get otherwise.

While at the electric light, however, the collector has not everything his own way as there is another competitor, whose nature it is to also visit the lights for the purpose of catching moths and other insects. I refer to the bats which frequent the electric lights securing many a desirable species, the wings of which are often found, the bat being seemingly contented with the body portion. The size of the moth does not in the least seem to frighten the bat as I have seen him catch and fly away with as large a species as Telea polyphemus. The moths when chased by the bat make a desperate effort to get away, but in the end they are generally captured. Some, however succeed in evading the bat by flying straight up in the air just at the time the bat makes a swoop upon them. Many a specimen which looks to be a "nice thing" has been caught by these bats, much to the collector's regret. Sparrows also pick many specimens from off the poles in early morning, the moths having rested there until that time. Constant visitors to the electric lights are the toads which hop nimbly along the ground and snap up many a treasure that might otherwise have graced the entomologist's cabinet.

I have brought to the meeting some of the captures which we have been fortunate enough to make at the electric lights during the past summer. These no doubt may be of interest to the members present.

INJURIOUS INSECTS OF THE ORCHARD, GARDEN AND FARM FOR THE SEASON OF 1899.

By Prof. W. Lochhead, Ontario Agricultural College, Guelph.

The unusual severity of the past winter led many persons to anticipate a reduction in the numbers of injurious insects on account of the probable freezing of many of the forms which hibernate as pupæ or adults, but such an anticipation has not been realized, as most of the pests of past seasons have been quite as numerous and injurious this season.

The Orchard.

The Codling-Worm has again been active, and the damage done to the apple has been very considerable (Fig. 12). In the Guelph section the prolonged showery season during spraying time washed away the Paris Green from the calyx cups, so that the first meals of the young grubs were not poisonous. As there are two broods in the south-west part of the Province the orchardist should see that the first brood is exterminated, for if not, the second brood will do much damage to late apples. Last year many shippers lost heavily on account of the work done by the second brood, which is very hard to combat, from the fact that the members appear at very irregular intervals from August to October.

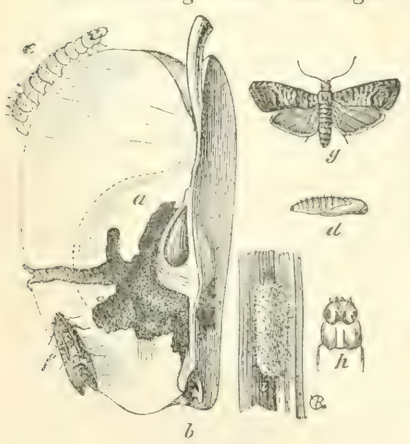

Fig. 12.

Fig. 13.

The work of the *Bud Moth* (Tmetocera ocellana) on the young buds was very noticeable in some localities where early applications of Paris Green were not made (Fig. 13). Experience has shown that one or two applica-

tions of a mixture of Paris Green and Bordeaux before the blossoms open are of great service not only in preventing the entrance of fungi, but also in killing young canker-worms and young bud-worms. The bud-worms, when they emerge from their silken cases in the spring, have shining black heads and the first segment behind the head also black.

Both species of *Tent Caterpillars* (Clisiocampa Americana (Fig. 15) and C. disstria (Fig. 14) were exceedingly numerous during the early spring, and did much harm in many sections. The farmers of the Province require to be aroused in this matter; they appear to make no effort to kill them during the most assailable period, viz., during the winter when the egg-masses (Fig. 15c) can be readily seen and destroyed, and during early spring when the caterpillars are small. Applications of Paris Green are very effective on the young caterpillar, but ineffective on the full-grown.

Many persons are under the impression that some plague comes over the full grown caterpillars when they suddenly disappear. It is true the caterpillars no longer exist as such, but it ought to be borne in mind that they have simply changed into pupæ within white cocoons (Fig. 15d), from which the moths will emerge about July to lay the bracelet of eggs on the twigs and branches.

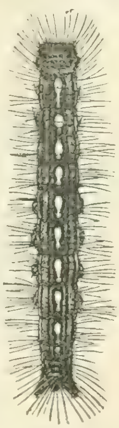

FIG. 14.

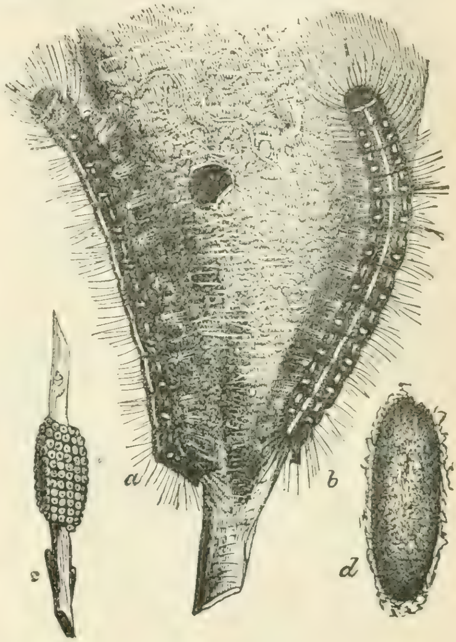

FIG. 15.

Bonuses might be given to the children for all egg-masses destroyed, or all nests burned.

The *Scale Insects* have perhaps become the most serious pests in many districts. The San Jose Scale, which has become quite abundant in two or three localities, as well as remedies for its suppression, will be found fully treated in another part of this Report.

In some localities, chiefly in the San Jose infected areas, is found a scale *Aspidiotus ostreæ-formis*, which is very like the San Jose Scale, but apparently not nearly so destructive. Occasionally trees have been found which were quite badly infested, in which cases much harm was being done. Applications of whale-oil soap (2 lbs. to 1 gallon of water) during the winter will prevent the spread of this scale.

The Oyster-Shell Bark Louse (Mytilaspis pomorum) is doing much harm in many orchards which have been neglected (Fig. 16). Frequently specimens of branches were received, which were literally covered with this scale, yet the owners had overlooked its presence, and not until several trees had been killed was expert opinion invited. Applications of whale oil soap (2 lbs. to 1 gallon of water) during the winter, and dilute kerosene emulsion, about the end of May when the young lice are moving, will rid the trees of these pests, and in most cases give a new lease of life to the previously neglected trees.

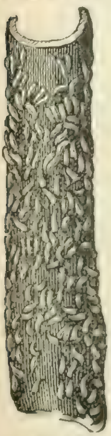

FIG. 16.

The Scurfy Bark Louse (Chionaspis furfurus) is another scale which is too prevalent in many localities (Fig. 17). It can be treated in the same way as the Oyster-Shell Bark Louse.

The Woolly Aphis (Schizoneura lanigera) This insect is readily recognized by its woolly covering (Fig. 18). It can be readily treated with applications of kerosene emulsion or tobacco water. It infests apple trees.

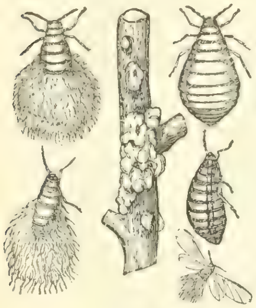

Fig. 18.

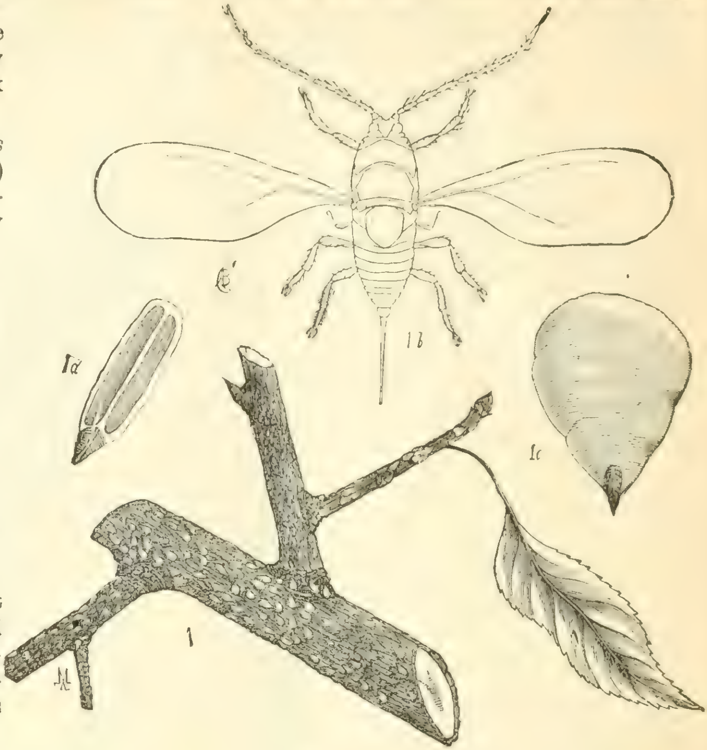

Fig. 17.

The Garden.

Slugs have been unusually plentiful, and those infesting the raspberry and strawberry were extremely troublesome. These are more dreaded than the other insects infesting these plants, inasmuch as they continue their depredations through the fruiting season, when it would be unsafe to use poison for their destruction.

Plant Lice or *Aphids* were quite troublesome on currants and gooseberries. They cause the leaves of the currant to wrinkle; in gooseberries rosettes or tufts at the tips of the branches are formed. Within these tufts can be found Aphids of all ages, and with these are the lady-birds trying their best to subdue them. The figures represent two common forms, Fig. 19 the 9-spotted, and Fig. 20 the 13-spotted.

Fig. 19.

Fig. 20.

The Raspberry Fruit Worm (Byturus unicolor) was more prevalent than usual this year. This small white worm about $\frac{1}{4}$ inch in length feeds on the flesh of the berry close to the receptacle. Their presence is often overlooked in the preparation of the fruit for the table.

At the College both the raspberry and the blackberry were slightly damaged by the presence of galls on many of their roots, produced by a cynipid (Rhodites radicum). Wherever the galls were present the canes were found to be lying prostrate on the ground and a few died from the effects.

The Colorado Beetle (Doryphora decemlineata) was just as abundant as ever at the College this year, but it has been frequently reported that the severe cold of last winter killed many hibernating adults, and that the supply was much below the normal.

Much annoyance was caused by the presence of a very small black flea-beetle (Epitrix cucumeris) Fig. 21, on both the potato and the tomato plants. This beetle about 1-16 inch in length, is black with a whitish pubescence. This insect works upon the upper side of the leaf and makes perforations. It is easily overcome with Paris Green.


Fig. 21.


Fig. 22.

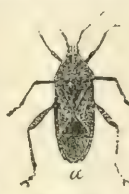
Fig. 23.

The Cucumber Beetle (Diabrotica vittata) Fig. 22, was as usual a great nuisance on the cucumber, melon, squash, and pumpkin vines. Many inquiries were made as to the best mode of dealing with these beetles. The remedy we found to be most effective was Paris Green with considerable lime added, applied with a knap-sack pump. The rod had an elbow so that the under sides of the leaves were thoroughly sprayed. This year applications of Paris Green were made whenever new leaves appeared.

The Squash Bug (Anasa tristis) Fig. 23, seemed to thrive this year in spite of every precaution. Decoy crops are generally very valuable, but were quite ineffective in most cases this year. Hand-picking of the leaves containing the clusters of eggs or nymphs was found very effective.

The Cabbage Worm (Pieris rapæ) was very plentiful this season, and did much damage to cabbage, turnip, and rape plants. In the case of cabbages the worms can be very successfully treated either by Paris Green and lime spray, or by dusting the leaves with insect powder, mixed with flower or ashes.

The Cabbage Aphis (Aphis brassicæ) did not appear in such numbers as they did last year, but the application of kerosene emulsion, diluted with 15 parts of water, to the under side of the leaves will practically exterminate them.

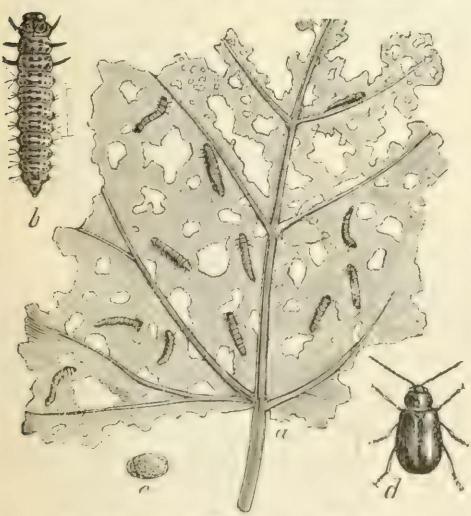
Fig. 24, *a.* larvæ on leaf, *b.* larvæ, *c.* egg, *d.* beetle (magnified).

The grape-vine had its usual enemies, but so far as my knowledge goes, the *Flea-beetle* (Haltica Chalybea) Fig. 24, was not so troublesome this year as usual, but it is still considered a bad pest. The best method of controlling it is, (1) to spray with Paris Green the buds which are just opening, and (2) again in June, when the larvæ are active, to spray with dilute kerosene. Many vineyardists go among the vines and hand-pick the beetles, or jar the beetles into a cloth saturated with kerosene.


Fig. 25, Grape-vine Thrips (the hair-lines show natural size).

The *Thrips* or *Grape-Vine Leaf Hopper* (Erythroneura vitis), Fig. 25, was perhaps more injurious than the flea-beetle. It was especially troublesome to the Virginia Creeper during late summer. If the nymphs which appear in June are then sprayed with dilute Kerosene Emulsion, and an elbow used so that the spray will reach the underside of the leaves, little harm need be expected for the remainder of the season.

A new and somewhat alarming pest has arrived in the Niagara peninsula. Last year Mr. Kilman noted the arrival of the Asparagus Beetle (Crioceris asparagi) at the

Niagara River. This year it has made itself quite destructive in Lincoln and Welland Counties. Two species preying upon the asparagus have arrived simultaneously, *Crioceris Asparagi* and *Crioceris duodecempunctata.* The latter has a reddish body with black spots, the former steel blue with white spots. W. N. Hutt, B.S.A. has at my suggestion kept a record of the work and life history of the beetles, and has prepared a short paper, which I have pleasure in presenting to this meeting. These beetles were first noticed by Mr. Hutt about May 8th, on the second or third cutting of the asparagus. The larvæ hatch from the eggs in about a week, and change into pupæ in two weeks, and in about ten days later the adult beetle emerges from the ground. There are probably several broods in the season and Mr. Hutt remarks: "The broods of the insects seem to be very numerous and to overlap one another, so that *eggs*, *larvæ* and *beetles* may be found any time during the summer." The same observer states that the best remedial measures would be:

1. Frequent cultivation of the ground to disturb or destroy the insect in the pupa state.

2. The removal of all spindling stalks on which eggs might be deposited.

3. Thorough spraying after cutting has ceased.

The C. 12-punctata was by far the more common form in the Niagara district.

The Farm.

My experience leads me to the conclusion that the insects which usually trouble farm crops were not serious pests in many portions of the Province.

The Wheat Stem Maggot (Meromyza Americana) did some damage in some localities. (Fig. 26.) The "White Head" can be readily discerned among the other uninjured stems. Like the Hessian Fly the adult is a four-winged fly which lays its eggs about

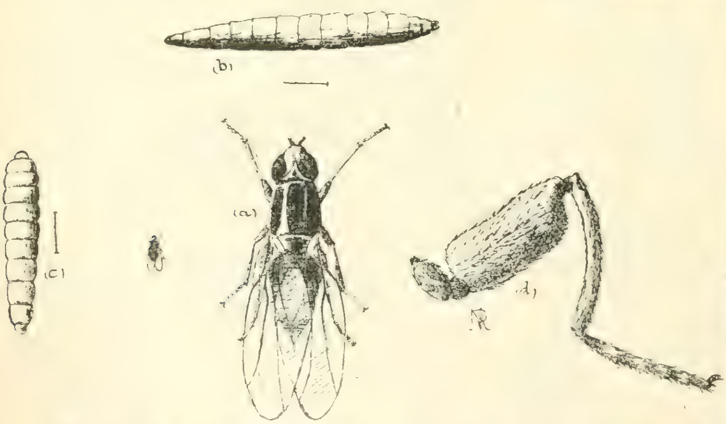

Fig. 26. The wheat-stem Maggot. *a*. The fly. *b*. The maggot. *c*. The pupa. *d*. Hind leg of fly, with large femur.

Fig. 27. The clover root borer. *a.a.a.* Excavations made by borer. *b*. grub. *c*. pupa. *d*. beetle.

May 15th, upon the stalk near the top point. The larva burrows into the stalk, and when mature is a worm about ¼ inch long. The flies emerge in July, to lay eggs for a second brood. Dr. Fletcher has determined three broods at Ottawa.

The pea crop still suffers very heavily from two very important pests, the *pea-weevil*, (Bruchus pisorum) and the *pea-moth* (Semasia nigricana). In Ontario the ravages of the pea-moth appear to be limited chiefly to the Counties of Dufferin, Grey, Bruce and Huron. From a study of its life-history it is very probable that the early varieties will not suffer much from the pest, as the larvæ do not appear before the middle of July.

As to the pea-weevil, its ravages are of such great importance that the general adoption of fumigation by carbon bisulphide after harvesting might with much good reason be insisted upon by the Government.

The Clover Root Borer (Hylesinus trifolii), Fig. 27, destroyed many clover crops this year in the vicinity of Belleville. F. R. Marshall, a recent graduate of the College, writes thus: "In early and middle June it was apparent that the red clover was not blossoming properly. Many plants did not blossom at all; many others produced imperfect heads. In fields where the clover was two years old, every plant was affected. In one year old clover a smaller proportion of the plants was injured, but since then the effects of the insect are noticeable all over the field.

I have not found any alsike clover affected. There were some Lucerne plants in the field, but they are not at all damaged.

Until July 12th, I found nothing but adults. On that date I found several larvæ, some well grown which were all in the lower portions of the root, and the beetles up near the crown. There were from 2 to 7 larvæ in a single root and 2 to 4 beetles.

On Aug. 8th, there were still many larvæ; some pupæ, and few adults.

On Sept. 5th, there were some larvae and many adults; the adults being in the lower portions of the root and very inactive.

Stored Grain frequently suffer from the depredations of certain moths and beetles. of which the *Granary Beetle* (Calandra granaria) is perhaps the most troublesome. It is a small brown snout beetle which punctures the outer shell in which she deposits her eggs. The young footless grubs eat the inside of the kernel, and in about six weeks from the time the eggs are deposited the adults appear.

The Saw-Toothed Grain Beetle (Silvanus surinamensis) is occasionally quite a pest. Just lately I received a package of wheat, from a farm near Waterdown, which had been stored, and which was very badly infested with both this beetle and the *Cadelle* (Tenebroides mauritanicus). According to some authorities it is supposed that the *Cadelle* is beneficial rather than harmful, as it preys upon the other pests.

ASPARAGUS BEETLES.

By W. N. Hutt, B.S.A., Southend.

Beetles were first noticed May 8th on the second or third cutting of asparagus (two species—one red with dark spots, the other steel blue with light spots). Little attention was given to the insects as they were not numerous and did not seem to eat the stalks at all. The red species was most commonly seen, the blue beetles being comparatively scarce. In a few days the dark elongated eggs were found in scattered patches on the small spindling stalks which were not cut. There were about 12 to 20 eggs in a patch. In a few days the eggs hatched and small dark larvæ resembling the pear slug appeared. They grew rapidly, eating the soft tissue just back of the growing points. On approaching them the larvæ have a peculiar habit of raising their heads and excreting a dark viscid fluid.

At the ends of the plantation adjoining a sod headland, the beetles were found to be much more numerous, owing undoubtedly to the fact that in the sod their pupæ had been undisturbed by cultivation. Here the larvæ attacked the large and marketable shoots and rendered them worthless by eating off the green portions behind the growing point and smearing them over with slimy castings.

After this the beetles were, during each cutting of asparagus, picked off and destroyed and all small and spindling stalks cut away so as to leave no harbor for the larvæ. In this way the larvæ were kept in check but the beetles, in spite of the most careful hand-picking seemed rather to increase.

About the middle of June cutting was discontinued and the whole bed, rows and all, cultivated up deeply with a large field cultivator. All stalks were then allowed to grow and in a couple of weeks there was a growth of between three and four feet in height. No attention was given to the insects as it was thought their time of doing damage had passed and that the plantation had top enough to suffer no injury. In the third week of July however it was found that a new brood of larvæ had developed and was working vigorously at the tops of nearly all the plants. They worked from the growing point downward, eating all the green portions as they went. On July 31st the whole plantation was thoroughly sprayed, using 4 oz. Paris green to 50 gallons of water, with 2 or 3 lbs. of lime to act as a fixitive. For a few days after many slugs could be found and it was thought that the spraying had not been very successful. However, in a week or so as the insects worked down they came in contact with the poison and were killed. As the summer was very dry this mixture stayed on all season and further damage from the insects was entirely stopped.

In some unsprayed plantations which I observed, the insects stripped the plants till they looked as white and bleached as they would in the depths of winter. I heard some gardeners remarking how the drougth had withered up the asparagus and they could not believe that it had been eaten off by an insect. Some plantations where the insects were at work showed a distinct line of demarcation between the deadened tops eaten off by the slugs and the green portion below that was not yet reached.

The broods of the insect seem to be very numerous and to overlap one another so that eggs, larvæ and beetles may be found any time during the summer. The pupæ I have not found but I expect they are in the ground.

The destruction by the insect is very general owing to the gardeners not knowing the insect or seeing its destruction till their plantations had been stripped. A few odd beds, however, can be found where the beetles seem to have missed them.

I should judge that owing to the destruction of the green stalks and leaves the elaboration and storing up of nutriment in the crown for next year's crop would be seriously interfered with, and that next spring the owners of unsprayed plantations might expect a reduced crop and one composed of rather spindling stalks.

From my experience I think that the best remedial measures would be :

1. Frequent cultivation of the ground to disturb or destroy the insect in the pupa state.

2. The removal of all spindling stalks on which eggs might be deposited.

3. Thorough spraying after cutting has ceased.

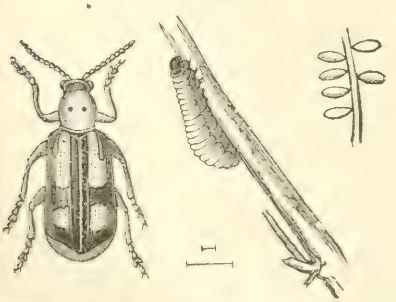

Fig. 28 (much magnified).

Fig. 29 (greatly magnified.)

These asparagus beetles are new to Canada and proved to be *Crioceris asparagi*, Linn. (Fig. 28), and *C. 12 punctatus*, Linn. (Fig. 29). The latter species was the most numerous.

PROF. WEBSTER said that it was remarkable that this insect, the twelve-spotted beetle, should have overtaken *C. asparagi*, which started for the east on its march across the country many years earlier, both being emigrants from Europe. He had observed that insects of this kind spread more rapidly westward south of the lakes than farther north The asparagus beetle had been found in south-west Michigan by Mr. Pettit, but he had not been able to trace it west of Sandusky in Ohio. The twelve spotted species had reached Buffalo. He mentioned also the almost total disappearance of the Harlequin Cabbage Bug (*Strachia histrionica*) in Ohio this year. Last year it was very abundant but its numbers had apparently been greatly reduced by the severe winter.

FATAL BITE OF AN INSECT.

BY REV. C. J. S. BETHUNE, LONDON.

During the past summer paragraphs appeared repeatedly in newspapers all over North America giving alarming accounts of the attacks of some marvellous insect upon the human person. The creature was called "the Kissing Bug" in consequence of its alleged habit of biting or stinging the lips of its sleeping victim and causing very painful if not fatal results. Much distress was caused among timid and nervous people and every unfamiliar insect, especially if large or ugly, was regarded as a specimen of the dreaded creature. Specimens of perfectly harmless insects (a *Cicada* for instance) were sent to the writer from various parts of Ontario with the expectation that they were veritable "kissing bugs" and he was enabled to allay these groundless fears in several quarters. Every entomologist had a similar experience and a list of the insects sent in on the supposition that they were representatives of the foe would be a long and amusing one.

On the first of September the following paragraph appeared in some Toronto papers and was speedily copied by a number of newspapers throughout Ontario :

"KISSING BUG'S BITE FATAL —Uxbridge, Aug. 31.—Roy Stevenson, the four-year-old son of Mr. George Stevenson, carpenter, of Udora, was bitten on the calf of the leg by a kissing bug on Thursday last. Dr. McDermott was called, but despite his best efforts blood-poisoning set in and the child died last night."

Here at last was a definite case with locality, names and date. I accordingly wrote to Dr. McDermott, whose address is Sunderland, Ont., asking whether the statements in the paragraph were correct, and if so, for a loan of the specimen in order that it might be identified. He very kindly replied as follows : "I will pack and send the insect as requested for identification. The boy died five days after being bitten. The part bitten was very painful from the first and the symptoms all through his illness were those of profound blood-poisoning. The little fellow was in good health when bitten and killed the insect immediately after it stung or bit him. His mother kept it rolled up in paper and gave it to me. It was bruised and damaged badly ; you will notice that the legs are broken and most of them gone and one wing is in the bottom of the box. It was over five-eighths of an inch in length but has dried and shrunk greatly. I may say the case is clear against the insect, whatever it is, as its bite was the direct cause of the boy's death." Some days later the doctor sent me the specimen and added : "We have not pronounced it 'the Kissing Bug,' and do not know what it is. It bit the boy under the left knee and the leg became very painful and swollen. He died from profound blood-poisoning on the fifth day. He was in good health previously."

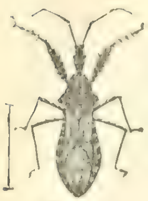
Fig. 30

With the assistance of Mr. Moffatt and the Society's collection, the insect though somewhat damaged, was identified as a specimen of *Sinea diadema*, Fab., which is the same as *Sinea multispinosa*, Am. and Serv. and *Reduvius raptatorius*, Say, who figures it in his "Entomology" (Le Conte's edition, vol. 1, plate 31; description p. 72, and vol. II, p. 249). It is a true bug of the order Hemiptera and family Reduviidæ, called "Assassin bugs" by Prof. Comstock from their habit of preying upon other insects. (Fig. 30.)

The specimen before us is a long narrow insect, dull brown in colour; the head is very long in proportion to the body, and much narrower, with a series of spines above; there are also numerous short blunt spines on the thorax, and a double series of sharp spines on the underside of the front pair of legs; the beak, with which it punctures its victims and sucks their blood, is long, three-jointed, and when not in use bent under the head, its tip resting in a groove between the fore-legs; these legs are very long, and adapted for seizing and holding its prey.

This Reduvius is a well-known insect, and is usually classed among the beneficial species from its habit of preying upon other insects, for the most part of an injurious character. It requires to be carefully handled, however, as it is quite ready to defend itself and inflict painful stings with its beak. Mr. J. Alston Moffat relates that on one occasion, some years ago, he captured a specimen, and held it between his finger and thumb, while with the other hand he searched for a pin. During the interval the bug took the opportunity of doing what it could in its own defence. Throwing its head well back it released its beak from the socket, and then forced it into Mr. Moffat's finger; not content with one puncture, it continued to draw back its head, and then force the beak down again into the wound, causing intense pain, until its human victim was able to get rid of it. He says that it was the severest sting he ever experienced during his many years of collecting; the pain extended up his arm, which became swollen to the elbow, and continued to be painful all night, while the wound on the finger did not disappear for several weeks. It is not likely that the insect injects any poison through its beak, as is done by the fang of a venomous serpent, but probably there remains adhering to it some of the juices of its previous victim—grub, caterpillar or what not—which have become decomposed, and thus poisonous to the blood. In this way we may account for the fatal effects of the puncture in the case of the child at Udora. As this is a rare, if not a unique, instance, the public generally need not feel any uneasiness regarding the so-called "kissing bug," and may rest assured that they are not liable to any new attacks upon their persons by venomous insects of a novel and malignant kind.

Dr. Fletcher said that the scratch of a pin has been known to induce blood-poisoning under certain circumstances, and it might well be that this bug's bite would only be serious after it had been feeding on some decomposed animal matter. Some years ago it was reported that a man was stung by an insect when working in nightsoil, and died from blood-poisoning shortly afterwards.

Mr. Moffat understood that the use of poison by insects was for the purpose of stupefying their prey so that they might feed in safety. He had observed these insects in contest with flies as large as a bumblebee, which could not be controlled unless stupefied.

Prof. Webster said that the bite of one Hemipteron, *Melanolestes picipes*, was very severe. He had experienced it once from a bug that he held in his hand, and was not likely to forget it, the pain was so great.

Dr. Bethune mentioned that Dr. Cowdry, one of the original members of the Society, told him that many years ago in England he had been hastily summoned to attend a brewer's carter, who had been stung on the lip by a large hornet. The patient

was a very stout man, who had evidently lived largely upon beer; blood-poisoning set in, and the man died the same night. A few years ago at the famous Johns Hopkins hospital, Baltimore, a boy was brought in suffering from the effects of a mosquito bite; every effort was made for his relief, but without success and he died shortly afterwards. These cases serve to show that the condition of the patient must often have much to do with the effects of the stings or bites of insects.

REMARKS UPON SOME CUBAN INSECTS.

BY J. ALSTON MOFFAT, LONDON, ONT.

On May 3rd, 1899, I received the following letter, which proved to be the introduction to a much valued correspondence; and the package containing the wasps referred to in it, was but the first of a series from the same source, containing numerous interesting examples of Cuban entomology, which have formed quite a valuable addition to the Society's exotic collection.

SANTIAGO DE CUBA, MARCH 17TH, 1899.

ENTOMOLOGICAL SOCIETY OF ONTARIO.

GENTLEMEN ;—I am sending you under separate cover a few specimens of wasps, which have a kind of root growing from them. I send you these to tell you of the belief here among the natives that the "Llana" a bush full of thorns has its origin from dead wasps. This affair was explained to me by Dr. Gundlach as being simply a fungus growth; it is quite acommon thing to find in the dry season, about February, a whole nest of these insects on the ground, all of which have these roots. I have also seen them with the leaf—always dry—on the roots. The specimens I send you are not very good, they only having one root each, but I have not at present any better ones, and as the rains have already begun I shall not be able to get any more till next dry season.

I might also mention that the Tarantula or "Arana Peluda" as it is called here, is supposed to give birth to the "Sarza" a vine with some very sharp thorns.

It is rather interesting to notice how the natives connect the sting of these insects with the thorns of the plants, and they will not be convinced that they are wrong.

I hope this may be of interest to you. I have never seen the Tarantula with the roots, but shall keep a lookout for them next season, and may be able to send you a specimen.

Yours truly,

CHAS. T. RAMSDEN.

A few days later the box came to hand with the specimens in fairly good condition; the fungus growths projecting from them conspicuously. The wasps are of medium size, exquisitely formed and beautifully ornamented in brown, black and yellow, but the colors lose much of their brightness when the insects are dried.

My first consideration was to obtain the name of the species, and for that purpose I sent an example to Prof. W. H. Ashmead, of the United States National Museum, Washington, D. C., who kindly and promptly forwarded to me the following letter in reply to my inquiry:

Smithsonian Institution, United States National Museum.

May 18th, 1899.

Dear Sir :—Your favor of the 8th inst., together with the wasp came promptly to hand. The specimen you sent me is the male of *Polistes lineatus* Fabr. a species widely distributed throughout the West Indies and South America. By some it is considered only a variety of *crinitus* Felton, but so far as I can see it is a good species and ought to be kept separated.

Yours very truly,

Wm. H. Ashmead.

Fig, 31—White grub fungus *Cordyceps melolonthæ.*

Vegetal parasitism, in one form or another is not an unusual occurrence in insect life. The Silk Industry of France was at one time threatened with complete destruction, by a form of it attacking the Mulberry Silk-worm, *Bomby xmori.* Illustrations of the effect of one form may be seen in specimens of our common housefly. Another form is known as the white-grub fungus; this white grub being the larval stage of the common May-beetle, *Lachnosterna* Sp. An interesting account of that form is given in the "American Entomologist," Vol. 1, page 92. In a letter from Mr. S. H. Y. Early given there, I quote the following particulars. "In the spring of 1842 I observed in what is called "New Ground" in Virginia a great quantity of these mushrooms, and in reply to some remarks I made about them, some of my father's negroes who were then making hills with hoes for planting tobacco, enquired of me if I knew what produced these mushrooms. On my replying in the negative, I was informed that they grew from the white grub worm (Fig. 31). I think there were some twelve or fifteen negroes present, all of whom concurred in the statement, and said it was no new thing to them. They had no difficulty in establishing the truth of what they stated, because they dug them up in all their stages of germination and growth before my eyes. In a very short time they had furnished me with a large number of the worms in their original shape, features and size, and as distinct to the eyes as if they had been alive, but having the consistency, color and smell of a mushroom; and I actually broke them up, just as a mushroom breaks in one's hands, snapping them crosswise and squarely off." At one time it was hoped that this fungus disease might be propagated at pleasure, for the destruction of the white grub in meadows, but so far it has not proved to be practical.

One can easily conceive of fungus spores vegetating on the soft body of a grub, but it is difficult to understand how they could obtain a foothold on the hard chitinous covering of these wasps. In another letter Mr. Ramsden informed me that they suspend their nests on a branch of a bush, so they cannot be specially exposed to contact with moisture; and yet they seem to be specially liable to this fungus attack, as shown by the following quotation from the paper previously mentioned: "According to Dr. Carpenter, it is not at all unusual in the West Indies to see wasps (genus *Polistes*) flying about with plants of their own length, projecting from their bodies." And again, in "The American Entomologist," vol. 3, page 138, when speaking of the species of fungus of the genus *Torrubia* which affects the white grub, Prof. Riley said "We have in our cabinet some interesting specimens of this stage affecting wasps of the genus *Polistes*, originating just as the White grub fungus does, from the base of the mandibles." In those received from Mr. Ramsden, the fungus had its origin in the immediate vicinity of the front pair of legs. With regard to the scientific name of the fungus affecting the wasps, Mr. Dearness did not find any of them

in a sufficiently advanced stage to enable him to determine it, and Prof. Riley said : "It is never safe to assume the identity of a fungus of this character unless it can be studied when mature, especially as there are at least a couple of dozen species of *Torrubia* known to inhabit insects." Mr. Ramsden informed me, that as the wet season had set in, he would not be able to get any more for some time.

Amongst other material received from Mr. Ramsden, was a pair of that occasional visitor to this locality, *Dilophonota ello*, Fab. belonging to the Sphingidae. He had taken the caterpillars in large numbers, feeding on a plant familiarly known there as "Lechero." Some were of a reddish-purple color, but the majority were green. He quoted Gundlach as saying they were destructive to the yucca crops in Cuba, they are also found on the papaya (Carica papaya), but there is a parasite that attacks the larva, *Microgaster flaviventris*, which keeps them in check. Mr. Ramsden bred a *dipteron* from his pupa, specimens of which he sent to me, but it has not yet been determined.

Also three specimens of *Chloridea virescens*, Fab. which he had bred from larva taken on Tobacco plants. Mr. Ramsden quoted from Dr. Gundlach's "Entomologia Cubana," the following about the larva of *virescens* : "Some were placed in a cage together with some of *Danais* ; Virescens attacked and ate the latter, also eating each other ; and some he held in his hand bit him." The border of the hind wings of the moth is usually blackish, but in one of those received from Mr. Ramsden the border was beautifully tinged with red. Mr. Bice took a single specimen of this southern insect in London at light in the season of 1896.

Of things received from Cuba, and occasionally taken in Canada, were specimens of *Terias nicippe*, *Eudioptis hyalinata* and what appeared to be *Junonia coenia*.

Mr. Ramsden sent for identification and to be returned, as it was his first and only specimen of a rare insect, which he had taken at light, a most singular looking creature. At first glance it suggested a butterfly and Dragonfly combined, as if made up for the purpose of deception. It had conspicuously stout antennae, about an inch and a quarter long, and heavily knobbed at the end, resembling those of a butterfly, with the long, narrow, and clear reticulated wings of a dragonfly. Upon close examination and comparison I was convinced that it belonged to the Ant-lions, and through the good office of Dr. Bethune I was enabled to send to him the generic name of the creature. The Doctor called my attention to Westwood's Introduction to the Modern Classification of Insects, vol. 2, p. 41, on the Order Neuroptera, Family Myrmeleonidæ, where there is a cut showing stages and parts of a variety of species, and amongst the parts is an antenna corresponding exactly to those of Mr. Ramsden's specimen, and on page 45, Prof. Westwood referring to the figure says : "The genus *Ascalaphus*, Fab. is remarkable for the peculiar structure of its antennæ, which are very long and knobbed like those of a butterfly, (fig. 63, 21.), whence Scapoli and others described one of those insects as a Papilio." I see by the Eleventh Report of the N. Y. State Entomologist, page 239, that there are six species of *Ascalaphinæ* listed by Banks as occurring in the United States ; five are southern forms, and one is found as far north as Massachusetts. It is supposed that the larvæ of this genus do not make pitfalls. Several observations have been reported of the females depositing their eggs on twigs of trees and blades of grass, and that the young lie in wait under sticks and stones to seize their prey. An instance is given of a Ceylonese species, *Ascalaphus insimulans* that makes no pitfalls. "Some young ones were found ranged in a single row along the stem of a lily with the abdomen of each covered by the one behind it, and with their jaws widely extended : in this manner they waited for their prey to literally walk into their jaws." Reference is made to some interesting notes published by Prof. Westwood in the *Transactions of the Entomological Society of London*, 1888, concerning this genus. It was a great pleasure to have the opportunity of looking at so strange a creature, and it would be yet more gratifying to be in possession of one.

THE WING STRUCTURE OF A BUTTERFLY.

By J. Alston Moffat, London, Ont.

Anosia Archippus, Fab. is, according to Dr. Buckell, of London, England, who gave much time and careful consideration to the investigation of this much disputed subject, the correct scientific name of our common milkweed butterfly, which, after several years of comparative scarcity in this locality, again appeared in great abundance during the season of 1899.

There are several questions yet unsettled by entomologists concerning the life history of this most noticeable, and usually one of the commonest of our butterflies, that require clearing up, and which tend to throw a halo of mystery around this familiar insect, which gives it special interest in the eyes of all who take delight in observing the ways and works of living objects in nature around them. Some things concerning it have been fully established; for instance, it is now a well known fact that *Anosia Archippus* cannot survive the winter, in any stage of its existence, in Ontario or northward of it. That each recurring winter sweeps our country clear of this particular species, aud it has to be restocked every spring by immigrants from the south; just how far south of our Dominion it has to go before it can live through the winter has not yet been satisfactorily settled. That it migrates southward in the autumn in immense bodies, sometimes numbering millions, is well known, and has been frequently observed; therefore it must return in the spring, but by scattered individuals, to take up the territory it vacated in the fall. Dr. Scudder says it belongs to a distinctively tropical group of butterflies, and that north of Philadelphia it clearly appears like an interloper. He also claims that it is a long lived insect; that a female starting northward may travel for weeks, depositing her eggs as she goes, a few at a time, until she reaches the northern limit to the growth of its food plant *Asclepias.* Dr. Scudder also holds that no *Archippus* born northward ever lays eggs the same season.

Mr. W. H. Edwards says that there are three or more broods in the season of *A. Archippus* in Virginia, and he does not consider it to be an unusually long lived butterfly; which caused him to remark that if it had such a lengthened period of existence in the mature state as Dr. Scudder claimed for it, then instead of giving it the common name of "The Monarch," a more appropriate name for it would be the "The Patriarch." Prof. Riley's idea was that fertile females of the hybernating groups in the south started northward in the early spring, when the milkweeds were ready to receive their ova, and would travel some distance before they had finished ovipositing, when these would naturally perish; then their progeny would continue to advance and carry on the work of producing ova to stock the milkweeds as they come on in the north. Thus, there might be several broods required in a season to reach the northern limits of its food plant. I have not yet formed any decided opinion upon these different views, for as much observation and consideration as I have given to the subject, some of my observations sustaining one side, and some as strongly supporting the other.

The wonderful power for sustained flight over long distances of Anosia Archippus is now well substantiated; individuals having been frequently seen at sea hundreds of miles away from land. That a longer term of life in the mature state than is allotted to butterflies generally, to enable it to fulfil its seasonal functions seems to be required; for if the same individuals that leave the north about the end of August or beginning of September pass the winter in the south, and then return northward in the early spring to deposit their eggs for the summer's brood, it wonld give them a much longer active life in the mature state than falls to the lot of butterflies that hybernate in this region. Whether any of those passing the winter in the south, reach the far north the following season is yet open to question.

I have seen specimens arrive in the spring in a sorely faded condition, indicating age and exposure to the weather, followed by others that were comparatively fresh, as if they were younger and less travel-stained than the first. Then again, I have seen the first arrivals in fairly good condition, as if they had not been long upon the wing. Such observations start the questions: were any of these specimens hybernators from the south,

or were they the progeny of hybernators? Then from how far south had they come? Again I have seen specimens haunting a particular locality for weeks, and as far as I could judge by their gradually failing colors they were the same individuals; had these permanently settled down in that locality, to go no further north? Again, I have seen them flying plentifully for six or eight days and then begin to pair; indicating that these particular individuals had not laid eggs before reaching that locality. I have seen fresh-looking specimens flying at the time the new brood was emerging from the chrysalis, and so fresh as to give rise to a difference of opinion, as to whether they were previous arrivals or bred on the spot? I have seen quite small caterpillars on the milkweeds when others had passed into the mature state; all of which have convinced me that there is more than one wave of migration northward during the breeding season.

These statements prove nothing, but they will help to indicate where the missing links are situated, which yet require to be forged to complete the chain of the life history of this particularly interesting creature; and will serve as a guide to those who are inclined and have the opportunity, to continue the observations, and make the evidence positive rather than presumptive.

Ever since the season of 1894, when I first discovered that the upper and under membranes of a butterfly's wing could be separated from each other, my desire has been to make further investigations in the matter, so as to prove or disprove what I thought I learned at that time. Then with the appearance in abundance of *Anosia Archippus* in the early season of 1899 I fondly hoped that my opportunity had arrived. The first one I saw was about the middle of May, in an unusually battered condition, and from that on until about the end of June they kept increasing in numbers, till they were to be met with everywhere. I requested friends to endeavour to secure for me a number of nearly full-fed caterpillars from the milk weed, so that I might have plenty of material with which to prosecute my investigations. Mr. Balkwill was the first to respond, on the 22nd of July, with a newly transformed chrysalid and several large caterpillars, which were followed by more from the janitor of the Y.M.C.A. Then I made a trip on the street car to a common in the vicinity of his residence, where *Asclepias cornuti* was growing in profusion, and I secured yet more, so that before the first had emerged I was in possession of fourteen pupæ, and Mr. Balkwill added four more to the stock subsequently, and they were all required.

The great advantage in procuring this particular species for such an investigation is not so much on account of its numbers in an abundant year, or the ease with which it can be fed up, but in the character of its crysalid, which is a pale translucent green, whilst the butterfly is a bright brown with black veins and white spots. These colors when the pupa is approaching its crisis show through the thin transparent pupa-case, which gives one an opportunity of clearly observing the progress it is making towards maturity, when it can be arrested at any stage desired; or, with a little practice, one can tell within a few minutes of the time when it will burst its bonds, and so obtain warning to be on hand to witness its disclosure and development, and then secure it in the proper condition, for the purpose intended.

I was surprised at the amount of mortality there was amongst the caterpillars after suspension; although I had been prepared to expect something of the sort from reading the chapter on "The critical periods of it's life" in Dr. Scudder's book, "The Life of a Butterfly." But there is no intimation given therein of the disease that afflicted my stock; which manifested itself by the caterpillar becoming flaccid, the skin opening and fluid escaping and forming long silky threads. If one of them hung its head straight down I knew it was doomed, and the other symptoms soon followed. It extended to some of the chrysalids There were no indications of parasitism in my lot. The time from the formation of the pupa to the emerging of the imago was ten to fourteen days. In no instance did any that I saw emerge drop from the pupa case to cause it to expand its wings suddenly. They came out of their case apparently with great caution and deliberation; and it took them from ten to fifteen minutes to fully expand their wings. The temperature of the weather through nearly all the period of their emergence was on the cool side, especially the nights, which would tend in some measure to restrain their energies.

It would be profitless to relate the difficulties I had to encounter in the prosecution of my investigations; and how I had to gain my information for success through failures in my efforts to accomplish the object in view; but it may be of use to anyone who wants to prosecute the enquiry to know what I learned during the process.

For the examination of an unexpanded wing, the chrysalid should be allowed to mature as nearly as possible to the point of emerging before it is killed, which I did by placing it in alcohol; then it is the better to hang for twelve hours for some of the moisture to evaporate. For the comfortable handling of an expanded wing, after full development it should be allowed to obtain complete firmness, which may take an hour or two, before killing the insect and separating the wing from the thorax. The only place that I could find an entrance for a pin point between the membranes, was at the base of the wing, where the subcostal and median veins come close together; when once the pin has entered, either in a vein or between the two, it can be moved back and forth through the entire width of the wing without encountering the slightest obstruction. The upper and under membranes of the wings are at the front and hind edges all in one piece, and must be cut to get them apart, which can be done by running the pin down through them, and so delicate are they, that this can be done without feeling that any extra pressure is required. Because of that extreme tenderness I had some difficulty in obtaining conclusive evidence as to the actual structure of the outer angle of the wings, until I bethought me of getting water between the membranes. With great care, after many trials, I succeeded in inserting a fine glass tube at the base of a wing, and soon had water flowing into it. Resting the wing on the surface of a tumbler of water, it soon rounded out like a bladder; but as soon as the water touched the outer angle the bladder collapsed, all the water having gone together, and the membranes were as before it entered. This sac will not hold water, the membranes being finished and fringed independently of each other at the outer angles.

The greatest difficulty in getting the membranes separated, and in getting them to stay apart arises from the gummy nature of the fluid that has entered between them from the thorax. If one separates a part of the wing and lets it go again, the sides are instantly as closely united as they were at first: or if a portion of the membrane folds in upon itself, one is far more likely to tear it than turn it back, in their efforts to straighten it. My available material had become reduced to three chrysalids, and I had not then obtained a perfect example, and was beginning to wonder if the effort was to prove a complete failure, when I thought of trying to separate them under water, and found it to work admirably. I could then separate the membranes without difficulty or danger; when separated I floated each half on to a bit of oiled paper, transferred them to blotting paper with their outsides next to it, then allowed some of the superfluous moisture to evaporate before covering them and putting them under pressure to thoroughly dry, when they came out in perfect condition.

The fluid which had been stored up in the thorax of the pupa flows in between the membranes of the wings at the opening by the subcostal and median veins, passing along and expanding them as it goes until the wings have attained their full dimensions; the fluid as it dries becomes more gummy and adhesive, and when perfectly dry the butterfly's wing with which we are all familiar is completed. The veins and nervures are situated half in one membrane and half in the other, the heaviest portion being in the upper membrane and open in the centre; so there is every reason to believe that the fluid does pass into, and through between them as it does between the membranes, but when it dries it forms such a thin coating on their inner sides that it practically leaves them empty. Then when the fluid has quite dried it has cemented the two halves together, which form the hollow tube that has been the subject of so much discussion; whilst at the same time it tends to stiffen and strengthen them as it does the membrane. Here I have the opportunity of correcting myself in a statement I made of what I thought I saw in an unexpanded wing. Twenty-fifth Annual Report of the Entomological Society of Ontario, page 65, where I state that "The nervures are in the upper membrane, with a groove in the lower opposite, into which they fit." That appearance I found frequently produced, by the walls of the larger veins in the upper membrane clos

ing together on the inner side; but their true structure can be clearly demonstrated in an unexpanded wing. And here I will express the opinion that the term "veins" is inappropriate and quite misleading as to their purpose and use.

The most recent statement upon this subject that has come under my notice is in an article by Henry Charles Lang, M.D., M.R.C.S., L.R.C.P., London, England, in the August number of *Science Gossip*, 1899, page 71, from which I will copy the paragraph headed, "The Vascular System:"

"This in butterflies is of a very simple character. The centre of the circulation is a rudimentary heart called the 'dorsal vessel,' situated on the dorsal surface of the abdomen and divided into several chambers. It is controlled by muscles attached to the abdominal walls, and by their action the blood is propelled into the aorta which is a prolongation of the dorsal vessel, having the form of a tube passing through the thorax to the head. The blood then returns through the lacunae or interspaces of the various organs to the abdominal sinus which surrounds the dorsal vessel and thence into the vessel itself through special valvular openings. There are, in insects, neither arteries, capillaries, nor veins in the true sense of the word, and the blood is cold, colorless and not corpusculated. As above stated, it is usually held that in butterflies *the nervures of the wings convey the blood to these appendages,* until they are fully unfolded after the emergence of the insect from the pupa. Circulation through these then ceases, the texture of the wings becoming dry and nonvascular. The nervures then perform the functions of air tubes." The italics are mine, and what I desire to call attention to is, that it is now time to cease disseminating that bit of misinformation. We have now attained to a fairly clear conception of the wing structure of this particular butterfly, and the question now to be settled is, are all butterflies' wings constructed on the same principle? It seems highly probable that they are, but positive proof is wanted; and I now consider it an easy matter to get it by anyone who can obtain a specimen in the proper condition. And as an inducement for anyone inclined to follow up the subject, I would recommend it to them as a most fascinating field of observation, and one well calculated to yield profitable results.

The photograph for the plate prefixed to this volume, was taken by Mr. R. W. Rennie, London, Ont., who, amongst his other accomplishments, is an expert amateur photographer.

Description of the Plate.

Fig. 1. Presents the inner sides of upper and lower membranes of a front and hind wing. These were separated under water and the gummy fluid washed off so the color of the outer surface shines through.

Fig. 2. The inner side of the lower membrane of a front wing.

Fig. 3. The hind wing of a male, disclosing the inside of the sexual spot.

Fig. 4. The inner side of an upper membrane of a front wing.

Fig. 5. The inner side of the lower membrane of a female's wing. These four membranes were separated as best I could before I tried it in water, the gummy fluid over the whole inner face of the membrane giving them a whitish appearance, as if they had got a thin coat of varnish.

Fig. 6. Shows the inner sides of the two membranes of an unexpanded front wing, with the basal portion of the costal membrane not separated. Its exact length is five-eighths of an inch.

Fig. 7. Gives a view of the natural size of a perfect front winglet. The opposite one is incomplete.

Fig. 8. The underside of a hind winglet. The opposite one is the upper side of another; both imperfect.

Fig. 9-10. Are the wings of one butterfly. The length of front wings from base to apex is two inches, by one and a quarter wide at the outer angle.

Upon one occasion, when engaged in separating some of the membranes, the inner sides of which, upon being exposed to view, had a reddish, raw appearance, a friend who had been intently watching the operation for a time, turned away with the remark, "Well, it's got down to a pretty fine thing now, when you've taken to skinning them!"

NATURE-STUDY LESSONS ON THE CABBAGE BUTTERFLY.

(*Pieris rapae.*)

By Prof. W. Lochhead, Ontario Agricultural College, Guelph.

Introductory Note. The purpose of the following Nature-study Lessons on the Cabbage Butterfly is to furnish information and question hints, regarding the structure and life-history of one of the most common insects of our Province, to those teachers who would like to introduce Nature Study into their schools, but are prevented from doing so by a lack of knowledge of insect structure and habits.

Nearly all insects begin with the egg stage. From the egg emerges the *larva*, (called *maggot* in the case of flies, *caterpillar* in the case ot moths and butterflies, *grubs* in the case of many beetles, and *nymph* in the case of grasshoppers, plant lice and half-winged insects.) The larva moults, or changes its skin, as it grows, the number of moults varying with the individual insect. The larva of the moths, butterflies, beetles, flies and wasps, on reaching its full growth transforms into a passive creature and sometimes spins a *cocoon* about itself, as in the moths; or becomes a *chrysalis*, as in the butterflies; cr makes a case within which it may rest quietly as a *pupa*, as in the flies and wasps. The nymphs of the grasshoppers do not transform, but with each successive moult become more like the adult insects. The adult form is usually winged, and is known as the *imago*, in the case of the butterflies and moths.

Nature-study lessons must be very informal in their nature. Their object is to make children observe, and to draw proper conclusions from the observations; to make them see what they are looking at, and to arouse an interest in the world of nature about them.

True teachers will find that the best objects for Nature-study are the most common objects about them. For this reason the Cabbage Butterfly has been taken in this case, and it is the sincere hope of the writer of these lessons that many teachers will make at least a beginning of this work, and give these most informal studies a fair chance among the other studies of the school.

Reference is here made to an article by the writer, entitled "Entomology in Schools," published in the last annual report of the Ontario Entomological Society, 1898, in which the names of the most important works on insects are given.

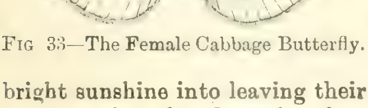

Fig 33—The Female Cabbage Butterfly.

Every child knows the pretty white butterflies, which are so common in September in gardens and along roadsides. These flit about from flower to flower, evidently not caring much what kind they visit. The despised dandelion, the execrable blue-weed, the ubiquitous yarrow, the notorious thistle are each in turn visited for the sake of the nectar or honey they contain. But September is not the only month when these white butterflies (Figs. 32 and 33) are abroad. As soon as the snow has melted in March, many of them may be seen flying about, lured by the bright sunshine into leaving their comfortable winter quarters for the deceptive breezes of early spring. With a relapse to cold weather many a poor butterfly is frozen to death. Those that have been rendered only torpid the returning hot sun's rays bring back to life again.

Fig. 32 —The Male Butterfly.

From their appearance in spring till autumn there is not a month when they are entirely absent, for there are three broods during the summer, and many of the late ones of one brood will be found flying with the early ones of the succeeding brood.

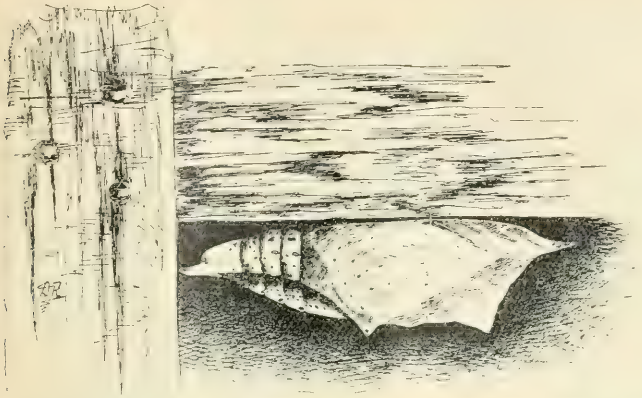

Fig. 34.—A Chrysalis of Cabbage Butterfly, showing the slender silken band by which it is slung up to the fence rail. The posterior end is attached to upright post in this case, but usually it is attached to the horizontal board. The projections of the wings, the legs and the coiled tongue are prominent.

(Fig. 34.) The cabbage butterfly winters over in the chrysalis state. A little search in late autumn will reveal many of these chrysalids suspended under the covering boards or rails of fences which enclose fields of turnip or rape. It will repay one to observe carefully, and make notes of, the peculiar shape of a chrysalis. It is about four-fifths of an inch long, and is generally of a light grey, or brown color. It is suspended at two points—at its pointed posterior end and at the middle of the body, by a silken cord that forms a band by means of which it is slung up tightly to the board or other object. The chrysalis case is quite thin and apparently brittle. The wings, coiled tongue, and legs can be fairly well recognized within the case. Every pupil should watch carefully the way the white butterflies emerge from chrysalids which have been collected.

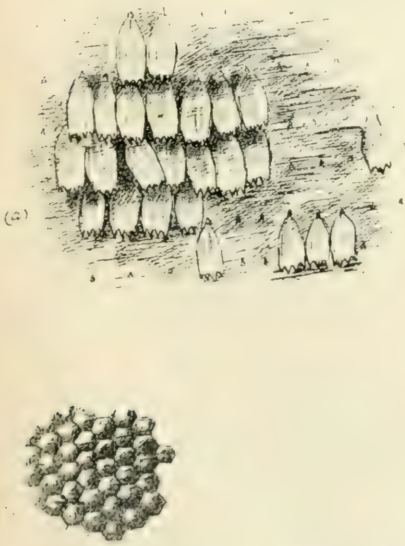

Fig. 35.—(*a*) A few scales on the wing, showing the shape of scales, their arrangement in rows, and overlapping, (much enlarged). (*b*) a portion of large eye, much enlarged, showing hexagonal facets.

Fig. 36.—An Imago of Cabbage Butterfly at rest on a leaf, showing the wings folded over the back, the three pairs of legs, the prominent eyes, and the long club shaped antennae.

The white butterflies have six well-developed legs, and four wings covered with scales (Fig. 35, *a*) which brush off very readily. (Do all butterflies have six well-developed legs? Do all winged insects have scales on their wings?) If we examine several specimens we shall very likely find slight differences in the number of black spots on the fore wings. The female butterfly (Fig. 33) has two black spots while the male (Fig. 32) has only one. We shall notice also that when the butterfly is resting on a flower the wings are held erect, (Fig. 36). (Find scale-winged insects which fold their wings by their sides when at rest.)

The antennae or feelers are thread like, and club shaped at the ends. (Have all butterflies and moth similar feelers?) The eyes are quite prominent, and if they are examined with a strong lens a large number of facets (Fig 35, b) will be seen. Such eyes are said to be compound.

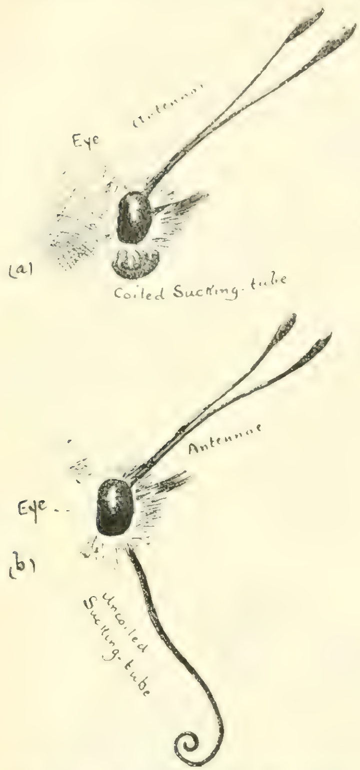

FIG. 37.— (a) Head of Cabbage butterfly, showing eye, long antennae and coiled sucking tube. (b) Head with sucking tube uncoiled.

FIG. 38.—A Cabbage Worm, showing the yellowish band along the back, the breathing pores, and yellowish dots along the sides, the three pairs of true legs in front, the five pairs of prop-legs behind, and the hairs and black dots on the back. (Somewhat magnified.)

Perhaps the most interesting structure of the butterfly is the long sucking tube which is usually coiled up like a watch spring, (Fig. 37, a). If we observe a butterfly while on a visit to a flower, we shall find that the sucking-tube is uncoiled (Fig. 37, b) and thrust into the corolla, and that the nectar is sucked by means of little muscles acting on a bulb or sac at the base of the tube. The process resembles that by which water is drawn up through a straw inserted in the mouth.

The eggs are laid by the female butterfly on the plant which serves as food for the caterpillar. Pupils should look on the underside of the leaves of cabbage, turnip, rape, mignonette, and other cruciferous plants for the pale yellow, flask-shaped, erect bodies, and examine carefully with a lens to find the vertical ribs on the eggs. The teacher should direct attention to the fact that the eggs are seldom placed in clusters but are somewhat scattered.

In about a week the tiny caterpillar comes out of the egg. (Note how long it takes to become full grown, and how often it moults). The color is green like its food-plant. All should examine carefully and find the yellowish band along the top of its back, the row of yellow spots along the sides and the fine black dots on its body. When full grown the caterpillar is nearly an inch in length. (Fig. 38). Then there are indications that another change is about to take place. (What are some of these indications? Where do you generally find the chrysalids?)

Very frequently in the autumn many cabbage-worms present a distended and sickly appearance. They are sluggish and have no desire to eat. If some of these worms be put in a box and taken to the house, where they can be observed frequently,

the cause for the sickness will soon become apparent. Small white maggots will bore their way out through the skin and congregate about the poor caterpillar as in Fig 39, *a*; and if these maggots be watched, it will be found that they soon begin to spin silken cocoons about their bodies (see Fig. 39, *b*.) The caterpillar has sometimes sufficient vitality left to crawl away from its tormentors an inch or two; but most frequently it dies beside them, and in a day or two no trace of its body can be found. If these cocoons be placed in a tin box for a few days, minute four-winged flies (Fig. 39, *d*) will emerge through a lid-like opening at the end of the cocoons. (Fig. 39, *c*.) These flies are parasites; they lay their eggs within the body of the cabbage-worms by inserting their needle-shaped ovipositors through the skin. In a short time the eggs hatch minute maggots, which grow and feed within the body of their host until they become full-grown, when they emerge as already described. It is very likely that the majority of cabbage worms suffer death through the agency of parasites. Even the chrysalids are not immune from the attacks of these parasites; for if many be examined, the interior of the case will in some instances be found filled with small maggots. Moreover the butterfly is eaten by many birds and other animals; so we are forced to conclude that the Cabbage fly has to contend with many enemies during its life-cycle (Fig. 40); that there

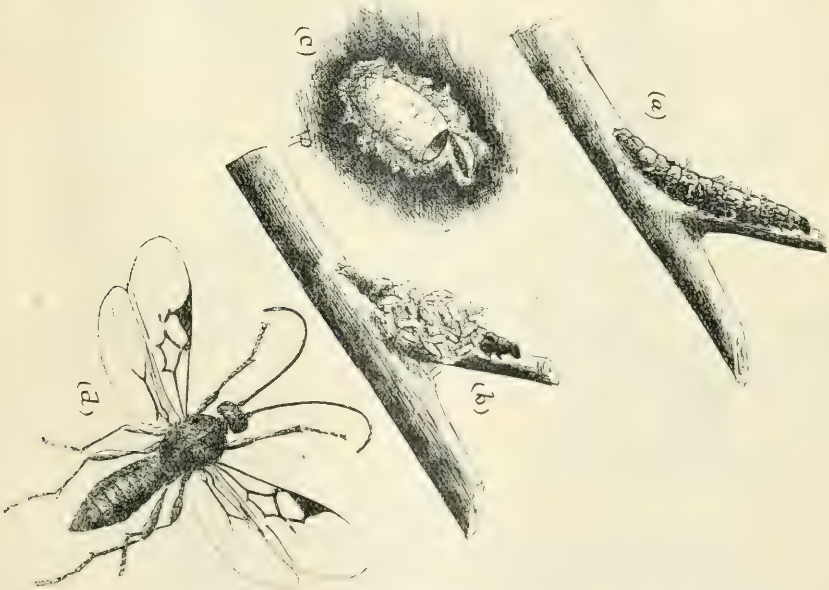

FIG. 39.—(*a*) Cabbage-worm with maggots escaping through the skin; (*b*) The maggots have transformed into pupae within cocoons; (*c*) One of the cream-colored cocoons with the lid-like opening; (*d*) The adult parasite fly which emerges from the cocoon, greatly magnified.

is a constant struggle for existence, and only a small fraction of the entire brood is left to propagate the species and to molest the farmer and gardener.

The respiratory or breathing apparatus of insects is rather peculiar. If a large Cabbage-worm be examined many openings may be seen along each side of the abdomen in the same line as the yellowish dots (Fig. 38.) These openings are the terminations of tubes which ramify through the body and supply air to the interior, so that an interchange of gases can take place, and the blood be purified.

A good practical method of killing the Cabbage-worms is to dust a mixture of one pound of insect-powder and five pounds of flour through a cheese-cloth bag upon the infested plants. The fine powder of the mixture clogs the breathing pores, and prevents the access of air to the interior of the body, so that the worm is virtually suffocated.

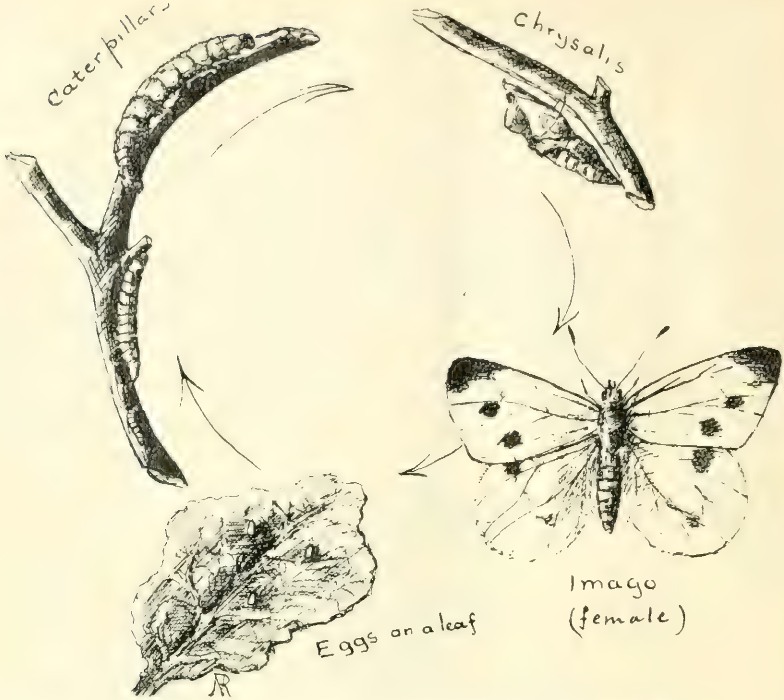

FIG. 40.—The four stages in the butterfly's life-history are represented, eggs, larvæ or caterpillars, chrysalis and imago.

FIG. 41.

FIG. 42.

The common Cabbage-butterfly is not a native of this Continent, but has been imported from Europe within recent years. It reached Quebec about 1860; in 1863 it was quite common about Quebec; in 1867 it was in Montreal; in 1868 it spread from New York where it had been introduced from Europe; by 1881 it had spread throughout the eastern half of Continent; by 1886 the Rocky Mountains had been reached; and now it roams from the Atlantic to the Pacific. It displaced the native species (Pieris protodice), Figs. 41, male, 42, female, driving it before it; but after thirty-six years of occupation the same native form re-appears with renewed vigor, and gives signs of competing successfully with the intruder.

LESSON I.—THE EGGS

Leaves of cabbage, turnip, or rape with the eggs should be collected. On which side of the leaves are the eggs found? Of what advantage? What is the shape of the eggs? The color? What kind of an insect lays these eggs? What kind of creatures hatch from these eggs? Do they resemble the mother insect? How long before the eggs hatch? (It is important that the pupils should have the eggs under observation. If possible the study should be made on the objects in the fields, under natural conditions, but leaves might be brought into the class room).

Lesson II.—The Cabbage-worms.

A supply of cabbage-worms should be on hand, and if possible a piece of half-eaten leaf with the worm at work before each pupil.

1. Why are some of the worms larger than others?
2. Describe the markings.
3. How many legs has the worm? Describe their location. Are all the legs of the same structure?
4. Describe how the worms eat.
5. What method of destroying the worms would be possible?
6. Watch carefully to find out how often a worm moults.
7. Follow closely the movements of a worm which has become full grown and has become restless.
8. Watch the large worms which have become sickly and have begun to change color, for the appearance of small white maggots. Where do these maggots come from? What change comes over the maggots?
9. Describe how a caterpillar breathes.
10. What would be the result if the breathing pores were plugged or stopped up?
11. Try the effect of spraying Paris Green water on some caterpillars. What objection is there to the use of Paris Green?
12. Dust some insect powder mixed with about five times as much fine ashes, through a cheese-cloth bag on some caterpillars, notice the effect.

Lesson III.—The Chrysalids.

A collection of chrysalids should be procured from the fences surrounding cabbage, turnip, and rape fields.

1. How are the chrysalids attached to the fence rails?
2. How long does this insect remain in the chrysalid condition?
3. Which surface of the chrysalid touches the surface of rest?
4. What signs of wings, etc., are to be seen?
5. Open some chrysalids to find if all are living.
6. In the dead chrysalids what do you find? How did the maggots get inside?
7. Locate accurately 25 chrysalids in the early winter; and in late winter, determine the number left. What has happened to those that have disappeared?
8. What then are some of the enemies?

Lesson IV.—The White Butterflies.

1. In what month did the first butterfly appear? If possible watch for its appearance.
2. When did the butterfly emerge from the chrysalid kept in a box in your room? Can you account for the difference in time?
3. Number of wings? Of legs? Number of parts to each leg?
4. How does the butterfly hold its wings when at rest.
5. What is the nature of its mouth? Can it eat? For what is its mouth adopted? Watch how a butterfly feeds.
6. Are the wings of all the white butterflies spotted alike? What does this difference indicate?
7. Has this butterfly any enemies? Name some.
8. Of what use are the scales on the wings?

Lesson V.—Other White Butterflies.

For this lesson the native Pierids should be shown the pupils. The differences should be seen. The teacher should then give the pupils a short history of the introduction of of this white butterfly to America, and its subsequent spread.

1. How would you distinguish the cabbage-butterfly from the *Gray-veined White and the Checkered-White*?
2. Collect caterpillars of each species, and learn to distinguish them.
3. Upon what plants does the caterpillar of the *Yellow*, or Clouded Sulphur Butterfly feed.

SPIDERS.

By Rev. Thomas W. Fyles, F.L.S., Levis, Quebec.

Spiders are not generally regarded as pleasant objects. I think most people have an antipathy to them. They dislike their appearance and their ways. At an entertainment given in a village that I know, songs, recitations and tableaux were intermingled. In one of the last named a little child was seen seated upon a hillock with a bowl of curds in her lap. She had been instructed to behave prettily and to take no notice of the people before her, but one thing she had not been prepared for. Suddenly a large toy-spider with all its legs dangling was let down, by an elastic thread, before her. Her start of unaffected terror was inimitable, and was warmly applauded, but of course this representation of little Miss Muffett could not be repeated. Yes, children regard spiders with fear, and older persons regard them with disgust; and yet there is much in spiders that is worth our notice, as I hope to show in the course of this paper.

Spiders are not insects. They belong to a different order, the *Arachnidæ*, which includes scorpions, ticks, mites &c., as well as spiders.

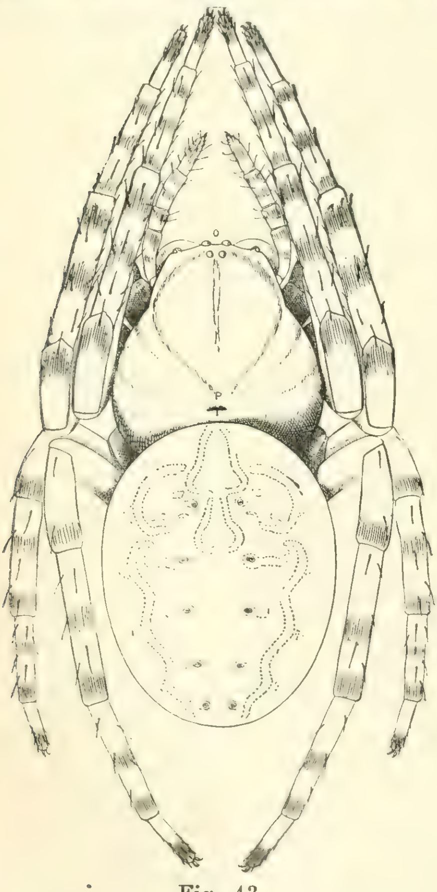

Fig. 43.

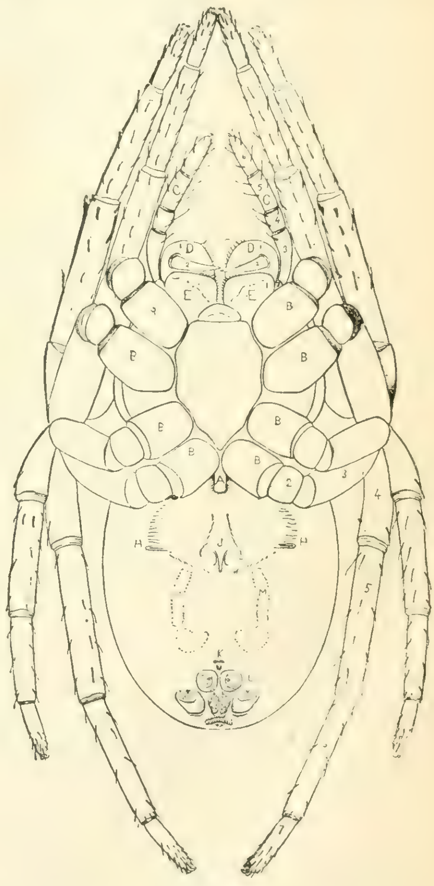

Fig. 44.

The word Arachnidæ is derived from the Greek Mythology. Arachne, as the story runs, was the daughter of Idmon, a Lydian. She was a skilful spinner and weaver, and was vain enough to enter into a contest with Minerva, who invented the arts Arachne practised. The ambitious mortal was defeated, and in her vexation hanged herself, but was turned by the gods into a spider.

Spiders differ from insects in the under-mentioned, as well as in some other, respects.

(*a*) In the spiders the head and thorax are united in what is called a cephalo-thorax. In the insects the head and thorax are distinct. (Fig. 43, upper surface of a spider; fig. 44, lower surface—both much enlarged).

(*b*) Spiders have no wings.

(*c*) They breathe by means of lung-sacs, through tracheæ which open under the abdomen.

(*d*) Their eyes are simple, not compound as in the insects.

(*e*) They have eight legs. Insects proper, in their perfect state, have only six.

(*f*) Their abdomens have no segments.

(*g*) After leaving the egg they grow, *but undergo no metamorphoses.* The insect passes from larva to pupa, and from pupa to imago.

Spiders have been divided into three tribes, according to the *number* of their eyes :*

I. Octonoculina—Eight-eyed spiders.

II. Senoculina—Six-eyed spiders.

III. Binoculina—Two-eyed spiders.

The families are named in most cases from *the habits of the species* they severally include.

Thus in the first tribe among others are found :—

The Salticidæ or Leapers (Fig. 45).

The Thomisidæ, or Binders (Fig. 46. The arrangement of the eyes is shown below).

The Drassidæ, or Seizers (Fig. 47).

The Linyphiidæ, or Weavers (Fig. 48), etc., etc.

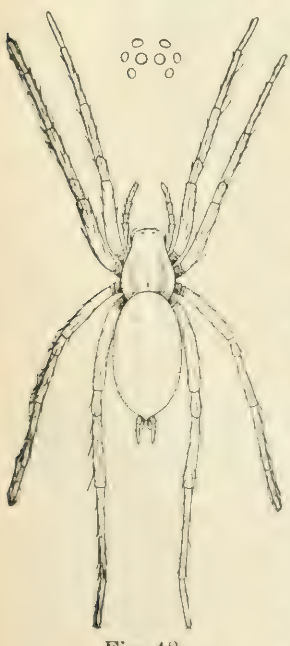

Fig. 48.

The form, colour and arrangement of the eyes assist the naturalist in determining the genera of spiders, thus :

The genus *Sphasus* has two large and six small eyes.

The genus *Salticus* (Fig. 45) has the eyes in three rows.

The genus *Philodromus* has them in two crescents.

The genus *Pholcus* has the eyes on prominent black spots, etc., etc.

The species are determined from *peculiarities of form, colour and markings.*

The spider has eight seven-jointed legs, terminated in every instance with three toothed-claws (Fig. 49), or with two such claws and a brush (Fig. 50). This may fitly be called *a hand-brush*, for the creature uses it for dusting its web.

Projecting from the spider's head are two six-jointed palpi, which are so large that they might almost be mistaken for another pair of legs ; and between these are the for-

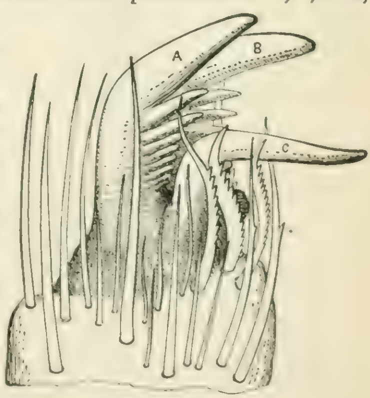

Fig. 49.

*Blackwall's "Spiders of Great Britain and Ireland."

midable mandibles (Fig. 51) toothed on the inner side, and furnished with fangs (*falces*) (Fig. 52) connected with a poison-gland. When the spider strikes a foe the virus is conveyed into the wound through a small opening in the fang (Fig. 52*a*).

Fig. 45

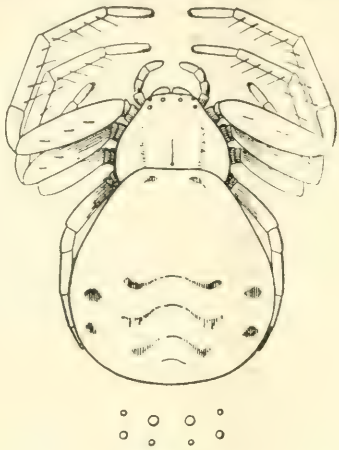

Fig. 46.

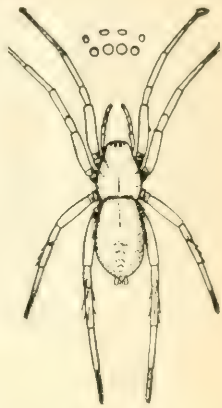

Fig. 47.

Behind the mandibles on the under side are the maxillæ or chewing organs. That the spider sometimes uses these without exercising its mandibles I know from experience.

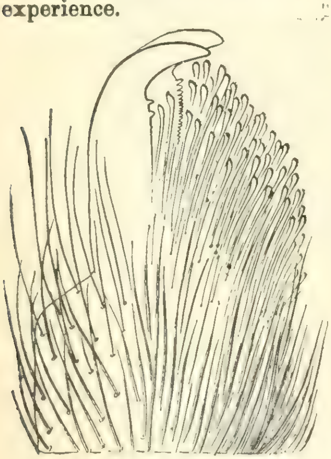

Fig. 50.

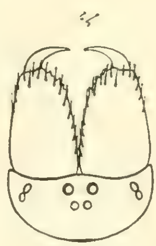

Fig. 51.

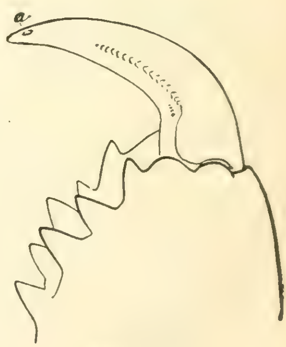

Fig 52

I was sitting one day, intent upon a book, when a tickling sensation on the back of my hand diverted my attention. I glanced down, and saw that a large spider was biting me. I shook the creature off, and found a cup shaped hollow—into which I could have dropped a mustard seed—where it had chewed away the flesh. Beyond a little passing irritation, I suffered no ill effects from the bite.

When the fangs of the spider are used upon a human being the effects may be exceedingly unpleasant. I knew a little girl who was wounded in the neck by a black spider. The flesh became greatly swollen and much discoloured, and the child was very ill. She was under the doctor's care for ten days.

The silk-bag of caterpillars is near the head; and the silken thread passes through and is controlled by the jaws of the insect. The spinning organs of spiders are near the other extremity of the body (Fig. 53). Inwardly they consisted of a number of glands,

and of tubes connected with these glands. The latter are gathered into clusters in the six outward spinnerets. The threads from all the tubes unite in the spinning, and yet in combination they form a thread so fine that it is only one-fifth the size of a silk-worm thread. It is so perfect that it has been used for marking divisions in scientific apparatus, for taking measurements of extreme delicacy and exactitude.

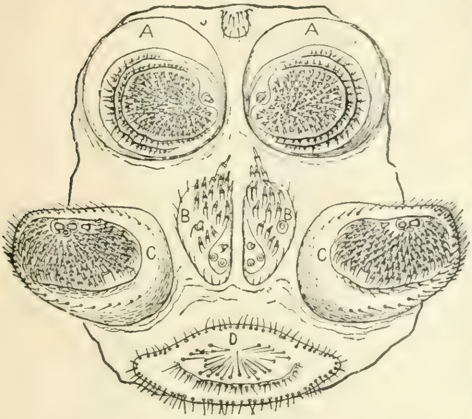

FIG. 53.

The female spider is generally much larger than the male. They do not live in the same nest, for the lady is of a capricious temper and has been known to fall upon and devour her mate. Indeed the cannibalistic tendencies of spiders are among the hindrances to rearing them with a view of employing their silk in manufactures.

There are, however, several species of spiders that frequent cellars, and that are of more peaceable dispositions than many of their kind; and these have been reared for a strange purpose. Fraudulent vintners after bottling and laying down their wine in cellars, have been ready to purchase spiders by the hundred at good prices. Set at liberty in the cellars of these men the spiders have speedily covered bins and bottles with a drapery of web that has conveyed the idea of age, and imparted a fictitious value to the wine.

The expedition with which spiders form their webs has ensured, it is said, on several occasions, the safety of fugitives. At a time of religious persecution in Europe, a man seeking a refuge crept into an oven, and a spider immediately commenced to spin its web before the door (Fig. 54). Before the pursuers arrived, its work was so far advanced that the men passed by the oven, remarking, "No one has entered there." A somewhat similar story is told by the Jews in regard to David, when he was in hiding from Saul, in the Cave of Adullam.

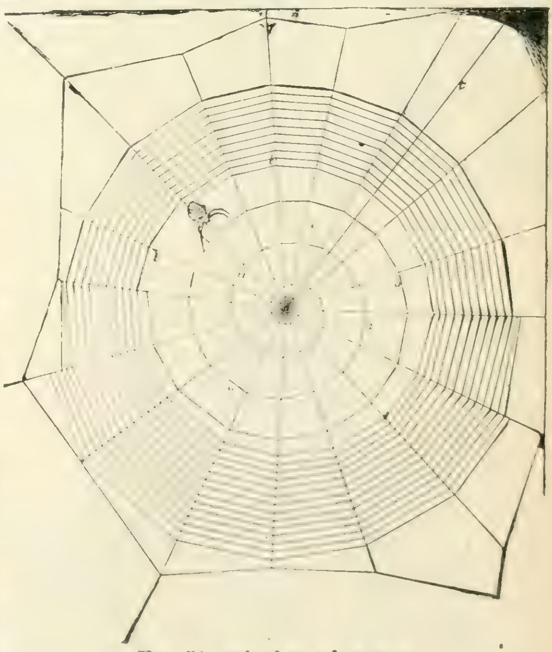

FIG. 54, web of an orb-weaver.

The perseverance of spiders in forming their webs under difficulties is remarkable. The well-known story told by Sir Walter Scott concerning Robert Bruce and the spider exemplifies this, and has thus been versified by Eliza Cook:

BRUCE AND THE SPIDER.

King Bruce of Scotland flung himself down in a lonely mood to think
'Tis true he was monarch, and wore a crown, but his heart was beginning to sink,
For he had been trying to do a great deed to make his people glad,
He had tried and tried, but couldn't succeed, and so he became quite sad.

He flung himself down in low despair, as grieved as man could be ;
And after a while as he pondered there, "I'll give it all up," said he.
Now just at that moment a spider dropped, with its silken cobweb clew,
And the king in the midst of his thinking stopped to see what the spider would do.

'Twas a long way up to the ceiling dome, and it hung by a rope so fine,
That how it would get to its cobweb home, King Bruce could not divine.
It soon began to cling and crawl straight up with strong endeavour,
But down it came, with a slipping sprawl, as near the ground as ever.

Up, up, it ran, not a second it stayed, to utter the least complaint,
Till it fell still lower, and there it laid, a little dizzy, and faint.
It's head grew steady—again it went, and travelled a half yard higher,
'Twas a delicate thread it had to tread, and a road where its feet would tire.

Again it fell and swung below, but again it quickly mounted,
Till up and down, now fast, now slow, six brave attempts were counted.
"Sure," cried the king, "that foolish thing will strive no more to climb,
When it toils so hard to reach and cling, and tumbles every time."

But up the spider went once more, ah me, 'tis an anxious minute,
He's only a foot from his cobweb door, oh say, will he lose or win it?
Steadily, steadily, inch by inch, higher and higher he got,
And a bold little run, at the very last pinch, put him into his native spot.

"Bravo, bravo!" the king cried out, "all honor to those who try ;
The spider up there defied despair, he conquered, and why shouldn't I?"
And Bruce of Scotland braced his mind, and gossips tell the tale,
That he tried once more as he tried before, and that time he did not fail.

Pay goodly heed, all you who read, and beware of saying "I can't,"
'Tis a cowardly word, and apt to lead to Idleness, Folly and Want.
Whenever you find your heart despair of doing some goodly thing,
Con over this strain, try bravely again, and remember the Spider and King.

The spider's web (Fig. 54) so frequently represented in pictures is that of the Geometrical Spider, *Epeira diadema*. It is formed with great regularity and is a beautiful object. Strange to say it is made up of two kinds of silk. The long, convergent, anchoring threads are not viscid, but the cross threads are thickly set with minute gummy drops, which secure the unfortunate insects that strike upon them.

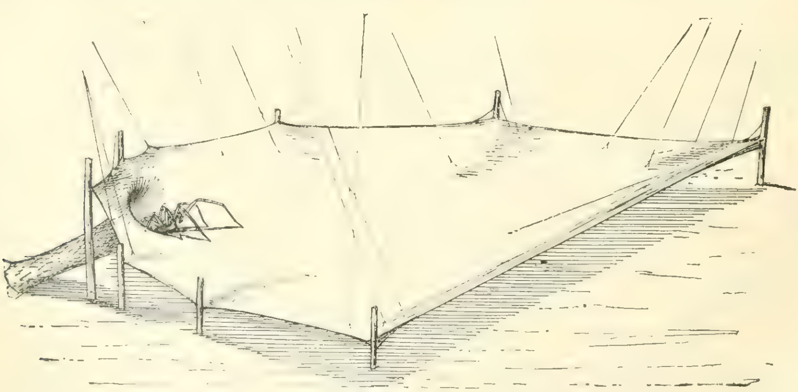

FIG. 55.

There is a species of spider (*Agalena labyrinthica*) which forms a closely woven web spread horizontally over the surface of the ground, and having a retreat at one corner of it (Fig. 55). It has been said of this, that, in the early morning, when the webs are white with dew, one might fancy that the fairies had been having a washing-day and had spread their sheets over the meadows to dry.*

The Gossamer Spider, *Neriene vagans*, often sets a fine silken thread floating at haphazard on the air. (Fig. 56). When this becomes entangled at the further end the spider secures the nearer one, and makes use of the thread as a bridge by which to

**Mr. Mygale's Hobby*, R. T. S. p 89.

pass to new hunting-grounds. The French call such threads *fils de la Vierge*. Sometimes the gossamer spider secures its thread and then spreads its limbs, and trusts itself to the summer air—the thread lengthening as it goes. Such spiders have been seen to alight on the topmost steeple of York Minster.*

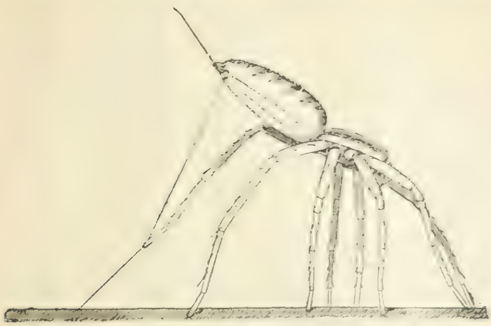

Fig. 56.

But the most remarkable of the weaving spiders is, I think, *Argyroneta aquatica*. This creature forms its web below the surface of the water. It shuns stagnant pools and rapid streams, but frequents deep ditches in which there is a gentle current. First it spreads its stays from one aquatic plant to another till sufficient anchorage is secured. Then from these it raises a closely-woven air and water tight dome, like the half of an egg-shell. Its next task is to supply this habitation with air, and to expel the water. Its proceedings for this purpose seem almost miraculous. It rises to the surface, throws itself over with a sudden jerk, and entraps, with a film of web guided by its hindmost legs, a globule of air about the size of a buck-shot. With this it scuttles down to its habitation, and dives beneath it. It then sets free its globule of air which rises to the top of the dome, and displaces some of the water. Repeated efforts fully accomplish its work ; and the spider has then an elegant, comfortable and secure dwelling-place. In it it lays its eggs, enclosing them in a cocoon or sack. Occasionally it makes an expedition for food, or to renew the air in its habitation. On the approach of winter it becomes torpid, and in this condition it remains till spring. As a boy, in one of the "Home Counties" in England, I often sat by a sluggish stream, and watched these spiders at their work.

The domestic spider (*Clubiona domestica*) is not a pleasant object. Its web is untidy, and its own appearance disgusting, but it intrudes everywhere. It "layeth hold with its hands, and is in kings' palaces."

Among remarkable spiders the Mygales or Bird-spiders hold the first place. Between thirty and forty kinds of them are known. The largest of them have a length of body of two inches and a half, and, when their legs are spread, measure eight inches from claw to claw. *Mygale fasciata* of Ceylon, *Mygale maculata* of South America and *Mygale Blondii* of the West Indies are among the giants. (Fig. 57. Mygale Hentzii of Texas).

Fig. 57.

Some of the Mygales are known as "Trap-door Spiders" They form tunnels in the earth several inches deep, and beautifully formed. The walls are hard and brown, but are lined with white silk, stiffened and

* Kirby and Spence's Entomology, letter XXIII.

smoothed with a natural cement. The doors of these habitations are wonderfully fitted and hinged, and close with their own weight.

Of the Wolf or Hunting Spiders the "Tarantula," *Lycosa tarantula apuliæ*, is a famous example. It abounds in the neighbourhood of Taranto (the ancient Tarentum) and Naples. In colour it is grey, and it has six angular black patches on the back of its abdomen. It is not a very large spider, being only a little over an inch in length. It hides in holes in the ground and under stones; and the bare-footed Italians are sometimes bitten by it. When a case of this sort occurs, the *fiddler*—not the doctor—is sent for; and the patient is kept dancing until utterly exhausted. After a brief rest he is aroused for another dance. And the exercise is renewed at intervals until the spider virus is supposed to have been eliminated.

There are some long-legged creatures that are commonly known as "Daddy Longlegs" or "Harvest Spiders." They are not true spiders—they belong to the Phalangiidæ. They have two eyes, one on each side of a sort of turret on the head. Their bodies are small and oval, and their eight legs are disproportionately long. They are useful creatures, feeding upon plant-lice and other insects, and, as far as I know, are quite harmless. Our commonest species are *Phalangium cinereum*, the ash-grey harvest spider and *Liobunum vittatum*, the striped harvest spider. Their eggs are laid in the ground, and the young come forth in the spring.

The naturalist who would collect spiders should carry a wide-mouthed bottle containing "*whisky blanc*." Into this he should drop the specimens as he finds them. He could afterwards place them separately in the same liquor, and in bottles of suitable size and form. The name of each specimen identified should be pasted on the bottom of the bottle. For classification the specimens might be placed in small racks—each *family* in a separate rack, and each *genus* in a separate row.

NOTES ON INSECTS OF THE YEAR—DIVISION I., OTTAWA DISTRICT.

By W. Hague Harrington, F.R.S.C., Ottawa.

My time was unfortunately so fully occupied during the season of insect depredations that my observations were very limited, and in consequence my notes are few and brief.

Grains and Grasses.—I did not hear of any insect attacks on wheat; neither was the Grain Aphis (*Siphonophora avenæ*) observed. The grasshoppers also were much less numerous than during the past year or two, possibly due to the unusual continuance of wet weather in midsummer. There was some Silver-top in old hay fields, caused probably by *Thrips poaphagus*, although Prof. Osborne has suggested that a large proportion of the injury known as Silver-top is due to the attacks of certain minute bugs.

Roots and Vegetables.—Cutworms continue to be troublesome, the commonest species being the Red-backed Cutworm (*Carneades ochrogaster* Gn.) The ravages of these very destructive grubs could be greatly lessened by a careful use of the traps mentioned last year and which are strongly recommended by Dr. Fletcher in his valuable reports. Such traps are formed by dipping bundles of weeds, grass or clover in a strong mixture of Paris-green and water, or by slightly damping bran and mixing thoroughly with it a little of the poisonous powder. Turnips did not appear to suffer much from the Striped Flea-beetle (*Phyllotreta striolata*) usually so destructive, nor from aphides, but towards the end of August they were pretty severely attacked by the White Cabbage Butterfly (*Pieris rapæ*) and by the diamond backed moth (*Plutella cruciferarum*). Onion, Cabbage and Radish maggots (*Phorbia*) were not quite as bad as last year, but still inflicted considerable loss. The White Cabbage Butterfly also considerably infested cabbages.

Peas and Clover.—A few peas have been found injured by the Pea Weevi (*Bruchus pisi*) but the insect is very rare in this district which is outside its usual limits

A new pest has been observed upon Sweetpeas in gardens, viz. the Pea Aphis (*Nectarophora destructor*) which was very bad on some hedges of sweetpeas late in the season. Owing to the wet season in July injury by red spider was only complained of in a few places. Some damage was done by the Green Clover Weevil (*Phytonomus nigrirostris*) a serious attack having been noticed in the experimental plots at the Central Experimental Farm. The Black Armyworm (*Noctua fennica*) attacked both peas and clover, and was also troublesome in gardens.

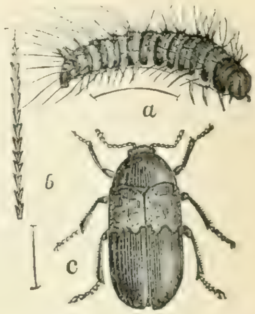

Fig. 58. Dermestes lardarius. A., larva; B., hair of do. magnified greatly; C., beetle.

FRUIT.—The Currant Aphis (*Myzus ribis*) was rather abundant, but was largely destroyed by the larvæ of various lady-birds (*Coccinellidae*)—The Currant Sawfly (*Nematus ribesii*) also continues to greatly defoliate currant and gooseberry bushes whenever prompt measures are not taken to destroy the broods. The last brood of the Cherry Slug (*Eriocampa cerasi*) was very abundant upon both plums and berries. The Oyster-shell Bark-louse (*Myrtilaspis pomorum*) has been bad in neglected orchards, but such places are naturally breeding grounds for many pests.

FOREST SHADE TREES.—The Tent Caterpillars (*Clisiocampa*) were again enormously destructive, and large areas were completely stripped, and the woods were rendered very unsightly and

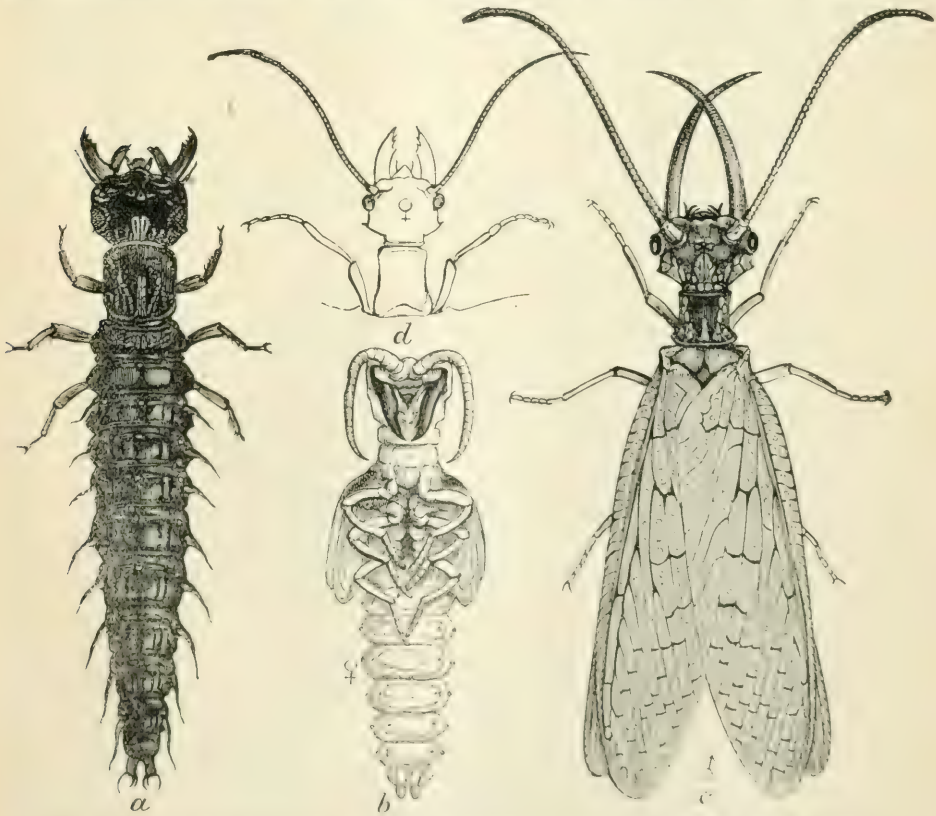

FIG. 59. Corydalis cornutus: A., larva; B., pupa; C., male; D., head and jaws of female.

uninviting by the quantities of webs and larvæ. Parasites, however, seem to be increasing, and many caterpillars also died from a fungous or bacterial disease.

The moths seemed less abundant around the electric lights, but in the woods there are now to be found many fresh egg-masses, so that the plague promises to continue next spring. The Yellow-necked Caterpillar (*Datana ministra*) did some damage to birches and was occasionally seen on elms. *Vanessa antiopa*, which is frequently a serious pest on our ornamental elms, seemed this year to confine itself to the willows. Elms, however, suffered very much from the attacks of plant lice, which were so numerous that the trees dripped moisture to such an extent that the sidewalks beneath them were kept quite wet for several weeks. The White Cedar Lecanium (*Lecanium Fletcheri*) was abundant upon some Arbor-vitae trees, but was severely attacked by the parasites which Dr. Howard bred from specimens which were sent to him some years ago from the Experimental Farm. *Nematus Erchsonii*, the Larch Sawfly, seemed to be more abundant there last year, although by no means in such numbers as it was several years ago, when its ravages resulted in the destruction of the greater part of our larches. The Spruce Kermes (*K. abietis*) has become more abundant and does serious damage, but the Spruce Sawfly (*Lophyrus abietis*) seemed less numerous. Canker Worms were little in evidence.

MISCELLANEOUS.—There was a remarkable abundance everywhere of *Dermestes lardarius* (Fig 58) and some houses were so infested that the beetles were a veritable plague After the July rains mosquitoes made their appearance all through the city in great numbers and were especially troublesome in the sections where lawns and gardens are most numerous. Many of the residents on such streets kept smudges burning every evening during the period of the abundance of these irritating flies. Kissing-bugs of various orders were brought in for identification, generally on the principle that the bigger the insect the more likely it was to be dangerous; the favorite competitor seeming to be the male of *Corydalis cornutus*, (Fig. 59).

NOTES ON THE SEASON OF 1899, DIVISION NO. 2.

BY J. D. EVANS, TRENTON, ONT.

Owing to pressure of duties the writer's opportunities during the past season for observing the presence of destructive insects were extremely limited.

One insect (*Clisiocampa sylvatica*) was, however, so numerous and destructive to the foliage of forest trees that the most unobservant person could hardly avoid noticing the destruction going on. From Trenton northerly to Bannockburn, a distance of about 46 miles, but more especially from Chisholm's Rapids northerly to the same point some 33 miles, the depredations were most severe. In many places the trees were nearly defoliated, but in some sections, blocks of woods were left without a vestige of a leaf. This caterpillar did not confine itself to forest trees, for orchards in the vicinity, although separated by many rods of cultivated land, were badly attacked, and one case can be recalled in the Township of Rawdon where an orchard consisting of from 100 to 200 trees was completely defoliated.

The caterpillars were in such immense numbers that on the 1st day of June, on the railway track, at a point about two miles north of Marmora station, the passenger train became stalled, and it was necessary to sweep the rails and use sand to enable the train to proceed. Three-quarters of an hour was consumed in making 300 yards.

The defoliated trees, releaved later in the season with diminutive leaves, in many cases however with large trees only the lower limbs showed signs of life. In sections where the insects had been prevalent in former years it was noticed that the tops of large trees were generally dead.

The Tent Caterpillars (*C. Americana*) were prevalent in neglected orchards; they were also observed to attack the mountain ash, their nests being seen on the trees.

NOTES ON INSECTS OF THE YEAR—DIVISION No. 3, TORONTO DISTRICT.

By Arthur Gibson, Assistant Entomologist, Central Experimental Farm, Ottawa.

Toronto and its vicinity have not, so far as I have been able to learn, suffered very seriously from the attacks of injurious insects during the past year.

The Tussock Moth (*Orgyia leucostigma*) caused some damage to shade trees, mostly horse chestnut, along many of the streets in Toronto during the past summer, but was not nearly so abundant as in the previous few years. One locality especially, however, suffered seriously, namely, the St. James's Cathedral property. The horse chestnut trees around the Cathedral were attacked and the foliage entirely destroyed in some cases. In 1896, the year Toronto was visited to such an alarming extent by this pest, many of these trees, were perfectly stripped of leaves. The Toronto civic authorities ever since 1896 have been painting the shade tree on a large number of streets, with a mixture, which I think is called "Caterpillarine," but this apparently has not been much of a protection. No doubt many of these caterpillars which had fallen to the ground were prevented by this sticky substance from climbing up the trees, but of course, it did not have any effect on the great majority which were up in the trees and which were doing the damage. I think if the civic authorities had taken this matter up at the proper time and sprayed the trees sufficiently, before the caterpillars got too large, with one of the standard arsenical mixtures, such as Paris green, or arsenate of lead, much of the foliage would have been saved, and the pest to a much greater extent stamped out. Much good work, however, was done by the destruction of large numbers of egg masses, which were collected from the trees by school boys and others, at a small outlay by the City Council.

The Tent Caterpillars, as in many parts of Canada, caused considerable damage to forest and fruit trees in the vicinity of Toronto. In early spring I noticed dozens and dozens of "tents" on wild cherry trees close to the Humber River. Many of the fruit trees in neighboring farms were also badly infected.

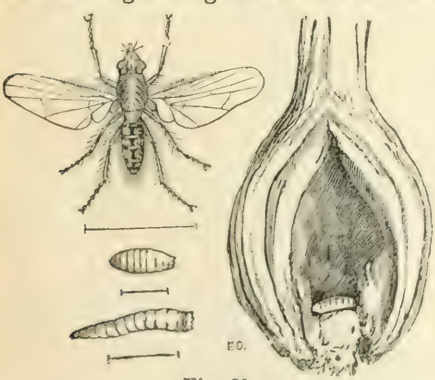

Fig. 60.

The Onion Maggot (*Phorbia ceparum*) Fig. 60, was troublesome in certain market gardens. Mr. Crew, in a conversation, mentioned that a friend of his has had good success in fighting this insect by the use of alum diluted in water, and sprinkled along the rows of onions with an ordinary watering can. All of these root maggots are difficult to treat, some experimenters obtaining results with certain materials, which in the hands of others appear to have been of little value. The most successful experiments recorded in Canada, mentioned in the Reports of the Dominion Entomologist, have been with carbolic acid, in some of its various forms, and white hellebore. Full details of these experiments can be obtained from his reports.

The Red Spider (*Tetranychus telarius*) Fig. 61, was reported as doing damage to sweet peas on the property of Mr. Edward Leadley, of Robert Street, Toronto, who stated that this insect had appeared in sufficient numbers during the past summer to injure his crop of sweet peas. These little creatures although commonly called Red Spiders are not real spiders, and are difficult to treat when they become once established. As soon as they are noticed, if the plants are sprayed with kerosene emulsion, or whale-oil soap, much good will result. Dusting with sulphur is also very useful. Sweet peas in Toronto were also attacked by the Destructive Pea Louse (*Nectarophora destructor*) which has done so much harm this year in Canada, particularly in New Brunswick and Ontario. Mr. Leadley writes that it was extremely injurious on his sweet peas. In other places it has not only attacked this favorite flower but also done injury to field peas.

In Parkdale, Toronto, many of the residents complain of the prevalence of fleas in their houses during the past summer. About the first week in September these little pests were extremely abundant, much to the writer's regret, as he spent a night at a friend's house, while he was visiting Toronto. These may have been introduced into the houses at first, no doubt, through the agency of some pet animal, and had probably multiplied during the summer absence of some of the residents. The young larvae feed upon animal matter in dust, and being very slender and active, penetrate into the smallest of cracks in floors, walls, etc., and where dust has accumulated will breed rapidly. Thorough cleanliness therefore, and a frequent use of scalding water, will do much to remedy the occurrence of this pest.

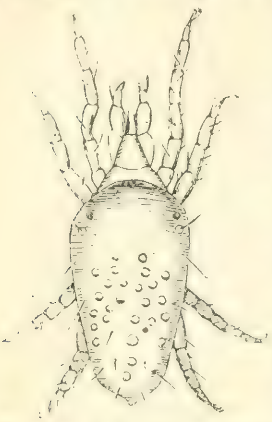

Fig. 61.—Red spider, greatly magnified.

Another insect which has caused some anxiety in Toronto during the past season is a black aphis attacking violets (*Rhopalosiphum violae* n. sp. Perg.). Mr. J. H. Dunlop, the well-known florist, has noticed the occurrence of this pest in his green houses among his violet beds. On the 13th October, when in Toronto, I visited Mr. Dunlop's houses and found this aphis very abundant, but fortunately it has not done much damage as yet in this country. Last year Mr. Dunlop's violets suffered from an attack of *Emphytus Canadensis*, the Pansy Sawfly, but this year he has not been troubled with this insect. A small pyralid moth (*Phlyctaenia ferrugalis*) appeared among Mr. Dunlop's rose bushes the past year, and its larvae occurred in sufficient numbers to cause some damage to the foliage of these plants. When full grown the larva is about ¾ of an inch in length, and is a semi-translucent green with a dark green dorsal stripe, on each side of which is a sub-dorsal white band. Those which were found by the writer, when in Mr. Dunlop's houses, were feeding on the underside of the leaf, which had been drawn together somewhat by means of a slight web, the injury seemingly being chiefly done by eating the soft tissue on the lower side of the leaves.

NOTES ON THE SEASON OF 1899.

By J. Alston Moffat, London.

From various causes, personal observations on the doings of insects during the past season, were with me decidedly limited ; so I was dependent in large measure upon the observations of others for my knowledge of what was going on in the insect world.

Fig. 62.

The Colorado potato beetle, *C. decemlineata*, was very late in putting in an appearance ; so much so that many thought that the severe frosts of the previous winter on the

bare ground had finished its career, but later on Paris Green was in demand all the same. The imported cabbage butterfly, *Pieris rapæ* was to be seen in abundance, especially during the latter part of the season. The moth of the climbing cutworm, *Hadena arctica* which was such an unwelcome intruder in houses in the season of 1895, was again in evidence, but in moderate numbers.

The superabundance of the Milkweed butterfly, *Anosia archippus*, (Fig 62) attracted general attention, even amongst those who are not in the habit of noticing butterflies. It appeared early, and kept increasing in numbers until about the end of August; whilst specimens of it were taken as late as the middle of October. One of our members who lives in the country, a short distance from the city, told me that he was out in a field one evening when he saw them in great numbers hanging to the heads of grain, and that he picked off several dozens of them with his fingers. Another of our members informed me about the end of August, that he had been in a wood to the North-East of the City with his dog, which started them up by the hundreds from bushes where they had settled down for the night; and he thought it something very strange, but I had no difficulty in showing him from books that it was a well-known habit of theirs. And yet this gathering in flocks at a particular place to pass the night together like birds, long before their time for migrating has come, is indeed a singular disposition for butterflies to display. (Fig. 63.) During daytime they care nothing whatever for each other's company, but fly aimlessly about as solitary individuals, as if they were in a meditative mood. When, with night's approach they begin to congregate at their rendezvous, then they cannot get close enough to each other; but will crowd themselves in where there is no room, to the great inconvenionce of those already there, and so cause much commotion in the flock before they finally settle down for their night's repose. *Anosia Archippus* appears to be an Entomological Enigma.

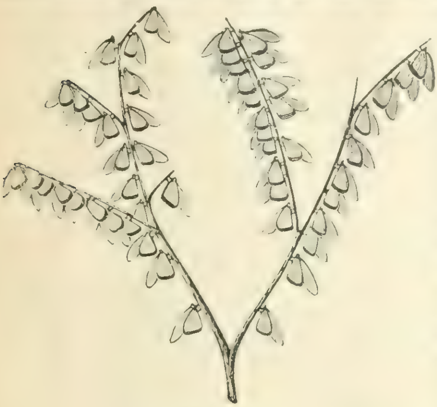
Fig. 63.

Reports of the butterflies appearing in vast numbers have been received from various localities, and newspapers have reported swarms of them as filling the air, but no intimation was given as to whence they came or whither they were going; indeed, the observers probably did not know that it was of any importance as to where they were going, or if they were going anywhere at all in particular, and so missed an opportunity of adding to our knowledge in this matter.

This has been a favorable season for making observations, as they were moving in masses that could be easily watched. and a definite idea obtained of their rate of travel and the direction taken by them. But this is a kind of work that a central bureau of entomological information can alone accomplish satisfactorily. Notice could have been sent in of their having left the north, and warnings issued to every observer to be on the lookout for them on their way south, and thus a connected account obtained of their movements from start to finish.

Mr. Bird's paper in the *Canadian Entomologist*, vol. 30, page 126, giving his method of securing the larva and pupa of a variety of species of the genus *Hydræcia* in their different food plants, and thus obtaining the moths in a perfectly fresh condition, which is of such advantage for the correct separation of the species in this genus, created much interest amongst collectors, and an effort was made here to follow out his directions, which resulted in a good measure of success. Mr. Rice secured in large numbers *H. cataphracta*, *H. nitela* and its variety *Nebris*, from Burdock, Giant Ragweed, Elder and Wild Parsnip. Mr. Balkwill collected in Burdock principally, from which was obtained a fine series of *Cataphracta*, with an interesting amount of variation in the depth of coloring, and in the conspicuousness of their ornamentation, which was gratifying to secure. Thus, although the hunts produced nothing new, they gave encouragement to the hope

that with the knowledge acquired, better results may follow renewed efforts next season. There are species of *Hydrœcia* taken here whose food plants are not yet known, and a knowledge of which is of sufficient importance to warrant an expenditure of time and labor in an effort to try and discover them. But, as Mr. Bird has remarked, more species may be found in that way whose presence was never seen or suspected in that locality.

During the past five or six years the ornamental Birch trees of this city have been showing signs of being affected by some disease; indeed, several large and much valued trees have died outright during that time. The preliminary symptoms are a weakening of the growth, and a thinning of the leaves at the apex of the tree, which gradually spreads downwards until the whole tree is affected and gives up its life. I have thought that it might result from the work of borers, and I have taken *Clytanthus ruricola* and *Agrilus bilineatus* on the trees, and have seen many holes in the trees out of which such beetles might have come,—with Woodpeckers' work conspicuous and abundant. And yet, if they are to blame, it does appear strange that the trees should be affected in that particular way; unless the borers are more numerous at the top than they are at the base of the tree.

A few important additions have been made during the past season to the Society's collection of native lepidoptera; amongst them are the following:

Orthosia helva, Grote. A species which I have had the impression for many years should be classed as Canadian, but could get no authentic record of its capture in Canada, until last summer, when Mr. H. S. Saunders of London took it at Ottawa, and presented a specimen to the Society.

Aglossa cuprealis, Hub. Taken at light by Mr. Bice.

Hydrœcia furcata, Smith. This was a capture made by Mr. C. G. Anderson several years ago. I regarded it as a badly faded specimen of some common form; but when seen by Dr. J. B. Smith, he informed me that the color was normal, and that it was really a very good species.

Hydrœcia stramentosa, Guenee. This is a species that has been regarded by Canadian collectors for the past thirty years as belonging to our fauna, and was placed in our label list as such; but all inquiries on my part failed to elicit any information concerning it, until I began to suspect that there had been a mistake made somewhere. Recently, whilst engaged in naming some material for Mr. Dwight Brainerd, of Montreal, a difference of opinion arose between us about the correct name of a *Hydrœcia*, which was settled by Dr. J. B. Smith in his favor. Then Mr. Brainerd sent me a second specimen of the disputed form, and with it another *Hydrœcia*, which he said he took at Montreal in numbers every season, and which was known to them as *Stramentosa*. And there, sure enough, was the long lost and much desired species, which had been kept out of sight, and from public knowledge through all these many years. This I regarded as the prize of the season.

NOTES ON THE SEASON OF 1899.

By Rev. C. J. S. Bethune, London, Ont.

The writer's opportunities of collecting and observing insects have been very limited this year owing to his removal from Port Hope to London in the middle of the summer. No one, however, could fail to observe the enormous abundance of Tent Caterpillars (*Clisiocampa*) and the amount of damage inflicted by them on the foliage of fruit and forest trees. From every part of the Province they were reported to be similarly abundant, though in many places much more destructive than in others. In the neighbourhood of Port Hope the "Forest" species (C. *disstria*) was not particularly noticeable and did not cause any injury worth mentioning; but the "Apple tree" species (C. *Americana*) was very abundant and destructive to foliage of fruit trees in gardens and orchards, especially

where no attempt was made to get rid of them.. In the winter the egg-bracelets may be cut off and destroyed, and in early spring the tents, or webs, can easily be seen in the forks of small branches when the tender leaves are expanding and can be removed without much difficulty. By adopting these means, the writer cleared his garden almost completely, a few stray caterpillars only escaping destruction.

The only other general outbreak of the year was that of various species of Aphides (plant lice), which have been swarming in myriads for several seasons now and attacking a large number of cultivated plants. The long continued drouth in the summer, combined with some very hot weather, reduced their number considerably and caused them to be much less troublesome in the autumn. During the two preceding seasons in October and November the air on sunny days was filled with infinite numbers of the winged specimens to the great annoyance of everyone out of doors, but this year, though numerous enough, they did not cause the same amount of discomfort and we may infer that they are not likely to be so abundant and destructive next year.

Every gardener and fruit grower has some insect or other to complain of; our familiar enemies are always at work, cut-worms, caterpillars, potato-beetles, codling worms, grasshoppers, curculios, slugs, sawflies, flea-beetles, and hosts besides, but there has been no one kind in more than ordinary abundance or requiring more vigilant measures for prevention than usual.

Among other insects—those that do no injury to cultivated plants—may be mentioned the handsome Archippus butterfly. Last year it was unusually scarce, but this year it swarmed all over the country, in cities and towns as well as in the rural districts. Even the most indifferent could not fail to be struck with the great numbers of these beautiful creatures which float so majestically in the summer air. Their curious practice of assembling in large numbers in the evening and roosting together was noticed by many observers. Night after night the writer observed them flying singly in rapid succession up the hill on which his garden stood, and, after a little soaring about, gathering together on the dead branches of some trees close to the house. Here they would huddle together in great numbers till the bough looked as if clothed with brown leaves of a triangular shape. If disturbed they would flutter about for a few minutes and then settle down again on the same or a neighboring twig. The late arrivals usually caused much commotion by trying to force their way in where there was no room for them. This singular proceeding lasted for many nights and was watched with great interest. When darkness came on they could easily be picked off with one's fingers without causing any alarm amongst those close by. In the early morning they were all off again on their individual duties or pleasures, and showed no desire for the companionship of others till the fading light of day caused them to look for a sleeping-place. The phenomenon is a singular one and not easily to be explained.

Another handsome butterfly, *Papilio Marcellus*, was seen again at Port Hope this summer. As this makes the fourth year of its appearance in the same locality, we may infer that it has succeeded in making a permanent residence there, though in very limited numbers at present.

In August last, the Editor of the "*Mattawa Tribune*" sent to the writer for identification, a caterpillar, which changed to a chrysalis before it arrived at its destination. It proved to be the Tiger Swallowtail (*Papilio Turnus*). About the middle of November, there emerged from the chrysalis, which had been kept in a warm room, instead of the expected butterfly, a large ichneumon fly, *Trogus fulvipes*, Cresson. This is rather a rare species, our common parasite of the Papilios being *Trogus exesorius*, Brulle, and is reported from the Province of Quebec, Maine and New Hampshire. It is almost entirely black with smoky wings, the lip, knees, tibia and tarsi being yellow.

The locust trees in and about Port Hope have been for some years severely attacked by the grubs of the well-known boring beetle, *Cyllene robiniæ*, and a large proportion of the smaller trees have been killed by them. In the case of older trees, branches and limbs are so much perforated that they break off when violent storms occur, but the tree itself does not usually succumb. Another enemy is now, however, at work boring into the solid wood, and it is not likely that even the largest trees will long be able

to withstand these combined attacks; this is called the locust tree carpenter-moth (*Prionoxystus robiniæ* Peck). The larva, when full grown, is between two and three inches in length and nearly half an inch in diameter; its borings through the solid wood are consequently very large and cause much injury to the trees. Fortunately the timber is of no commercial value, the trees being grown for shade or ornamental purposes, and being attractive chiefly from the fragrance of the blossoms and the ease and rapidity with which they can be grown. The moths of this species are very singular in appearance; the females are of a grey colour, similiar to the bark of a locust tree, the fore-wings being closely covered with a net work of black lines and having also some irregular black spots; the hind wings are of a uniform dusky color; the wings expand about three inches. The male moths are much smaller, expanding only about two inches, darker in colour and distinguished by a large bright yellow patch on the hind wings. They are so unlike the other sex that they might easily be taken for a different species. The females come into houses attracted by light in June, but the males are rarely seen.

The squash bug (*Anasa tristis*) fig. 23 has been very abundant this year on the squash plants, great colonies of larvae in all stages of growth being found; these are of an ashen grey colour with pink antennae. When they have reached this stage in their career, it is not easy to find a remedy; in the case of a few plants in a garden hand picking may be resorted to, that is they can be brushed off into a shallow tin dish and then destroyed. But where they are grown on a large scale for marketing, kerosene emulsion might be applied but would involve a good deal of trouble as the bugs are concealed and somewhat protected by the leaves towards the base of the plant. As the insect passes the winter in the full grown state, many may be destroyed in the autumn when they are wandering about in search of shelter; and in the early summer, when they come out to lay their eggs, they may be trapped by placing chips or small pieces of board close to the young plants; under these they will hide in the day time, and may then be readily captured and destroyed.

An interesting capture in London was made by Mr. Short, one of the city postmen. On September 26th, when going his rounds he found a perfect specimen of the large and handsome sphinx moth, *Phlegethontius cingulatus*, which is distinguished by the series of rose-red spots on each side of its abdomen.

NOTES ON THE SEASON OF 1899.

By Rev. T. W. Fyles, Levis, Quebec.

The season of 1899 was, at Quebec, a strangely variable one. The thermometer under my verandah recorded 93° in the shade on July 25th, and 43° in the shade on October 2nd—a difference of 50°. On the latter date there was a slight flurry of snow.

The weather was dry when rain was needed, and wet when fine weather would have been welcome. So dry was it, for a time, that the leaves of some exposed trees withered and fell untimely, without having taken the autumn tints. For the same reason the potatoes on the high land have been found to be small and few to the hill.

Insect Pests.

Early in the season the tent-weaving caterpillars of *Clisiocampa Americana* Harris and *C. disstria*, Hbn. were exceedingly numerous and troublesome. On the railway, in parts of the eastern townships, their crushed multitudes are said to have made the rails slippery, and retarded the progress of the trains.

On the Island of Orleans, early in June, the larvæ of *Hybernia tiliaria*, Harris, defoliated many young trees. (Fig. 64.)

Butterflies.

In June *Papilio Turnus* Linn, and *Danais Archippus*, Fab., were unusually abundant. On the 25th of the month I found Archippus larvæ in the second and third stages. At the same time the female butterflies were hovering about the milkweed in numbers, laying their eggs one here and one there on the plant. The more advanced larvæ were full fed on the 4th of July, and suspended themselves for the pupal change. A day later they cast the last caterpillar skin, working it upwards till it reached the cremaster, when a succession of convulsive twists dislodged it, and it fell to the ground. The abdominal segments were then drawn up and shaped into the rounded summit of the very beautiful pupa. The pupa changed from green to a rich mahogany brown in the night of July 16th-17th, and the perfect insects appeared in the afternoon of the 17th. Butterflies of this species were on the wing throughout the month of August

Fig. 64.—Hybernia tiliaria: the winged male and wingless female moths; larvæ of various sizes.

In July *Chrysophanus epixanthe*, Bd., and Lec.. was unusually abundant at the Gomin Swamp.

In August larvæ of *Grapta interrogationis*, Fab., were found feeding upon hops which shaded the verandah of the country residence of the Hon. Richard Turner, on the Island of Orleans.

In this month I saw *Pamphila Manitoba*, Scud, on the Heights of Levis, but not in numbers.

Saw-flies.

In the Society's Annual Report for 1897, on page 73, I gave an account of the saw-fly larvæ that fed on poplar, and a description of the perfect insect. Mr. Ashmead has since identified this for me as *Nematus luteotergum*, Norton.

On the same page I described saw fly larvæ that fed on *Cornus*. They buried themselves in October, and I found some of the larvæ quite fresh in the Spring, but they failed to pupate, and perished. Last fall I obtained a new batch of the larvæ and placed in the cage with them some pieces of decayed birch-wood. On the 15th of September, immediately after a moult, they proceeded to tunnel into the wood. All had disappeared before the 24th of the month. It was amusing to see how expeditiously and neatly the creatures accomplished their task. Every larva cleared its way with a whisk of the after part of its body, which scattered the *frass* in a regular circle of about the diameter of a half dollar. The finished hibernaculum was a clean-swept, oval chamber, just large enough to hold the larva comfortably. In this the creature remained unchanged till the middle of June. On the 20th of June I saw the skin of one specimen burst at the head and reveal the pupa. The insect in the pupal stage was seven and a half lines in length, waxen in appearance. The head was distinct, and the eyes showed through the skin as

reddish-brown spots. The antennæ and legs were free. Imagos of the species appeared in the last week of June and the first week of July. They proved to be *Harpiphorus tarsatus*, Say.

In the beginning of July, in examining a discolored larva of the species, I made a small opening in the head and suddenly a very active specimen of *Hemiteles mucronatus*, Prov., burst forth. Individuals of this species had previously shown themselves in the cage.

A Parasite of Hylotoma Pectoralis, Say.

In the beginning of the season I obtained a specimen of *Pimpla inquisitor*, Say, from a pupa of *Hylotoma pectoralis*, Say.

Dates of Appearance of Certain Insects..

My insect breeding cage was placed out of doors, and was buried under the snow during the winter. It was not taken in till the spring opened. The following then may be regarded as indicating the natural times of appearance of the species mentioned.

Papilio Turnus, Linn, appeared May 28th.
Papilio brevicauda, Saund, appeared May 23rd.
Sphinx Kalmiæ, A. & S., appeared May 25th.
Sphinx luscitiosa, Clem., appeared May 27th.
Paonias excœcatus, A & S., appeared May 27th.
Edema albifrons, A & S., appeared May 27th.
Cerura borealis, Boisd. appeared June 3rd.
Cerura scolopendrina, Bdv. appeared June 6th.

Sphinx Luscitiosa, Clem.

On the 27th of May two beautiful specimens of this moth appeared in my insect cage. The larva of the species feeds on *Populus tremuloides*. It is long in proportion to its girth. It is apple green in colour and has seven side lines. Each line is white below and mauve darkening to purple above. The last line is extended to the end of the horn which is green and rather short. On the body are numerous minute rings with white centres. These are most numerous on the 3rd, and 4th, segments, and along the sides. The head is green, and has a yellowish-white line down either side, supported by a dark purplish line outwardly. The cheeks beyond the lines are spotted with white. The true legs are whitish and tipt with brown. The larvæ were full fed on the first of September, and buried themselves in the soil.

Intruders.

Periplaneta Australasiæ.

In the beginning of June, a fine specimen of the Australian Cockroach (*Periplaneta Australasiæ*) was found in a bunch of bananas by Oswald Davie, a junior member of the Quebec branch of our society.

Tenebrioides Mauritanicus Linn.

In the middle of April, I discovered a number of "Cadelle" larva in some Graham flour obtained from a store in Levis. This is a description of them :

Larva 7 lines in length, greyish white in color, somewhat flattened in appearance, has white hairs thinly scattered over its body. The abdominal segments are larger than the thoracic. The head is brown and shining, as is also the plate on the second segment. The last segment has a peculiar dark brown forked termination. The legs are wide-spread, amber in colour. When near pupation the larvæ managed to escape.

A Busy Scene.

On the 14th of June I found a thorn-tree (*Cratægus crus-galli*, L.) in full blossom. Growing on the north-west slope of a cliff, it was later in flowering than other trees of its sort. I was surprised to see the multitude of insects that thronged it. In the few minutes that I stood by, I noticed many specimens of the undermentioned kinds :—

Butterflies—*Papilio Turnus*, Linn ; *Lycæna Couperi*, Grote.

Beetles—*Clytanthus ruricola* ; *Anatis 15-punctata*, Oliv.; *Cyrtophorus verrucosus*, Oliv.; *Leptura lineola*, Say ; *Donacia emarginata*, Kirby.

Two-winged Flies—A species of *Chionomus*; *Pangonia tranquilla O. S.*; *Stratiomyia obesa*, Loew ; *Milesia excentrica*, Harris ; *Syrphus xanthostomus*, Wied ; *Sericomyia militans*, Walker, *Sphærophoria Cylindrica*, Say ; *Musca Cæsar*, Linné.

Bees—*Apis mellifica*, Drury ; *Andrena nivalis*, Smith ; *Osmia bucconis*, Say.

Wasp—*Vespa maculata*, Fab.

Saw-flies—*Tenthredo lineata*, Prov.; *Monophadnus scelestus*, Cr.

Metzneria Lappella, Linn.

In the beginning of September, 1898, I discovered, in the heads of Burdock, a curious larva, of which the following is a description :

Head bi-lobed, brown ; mouth organs large. A brown plate, marked longitudinally by a white line, on the second segment. Body rounded, much crinkled, of a fatty appearance, having a few white hairs along the sides. Anal segment small and protruding. The legs small and weak. The pro-legs seemingly atrophied into mere pseudopodia. Length of larva two and a half lines.

On the approach of winter, the larva having eaten out a convenient hollow in the closely packed seeds, cemented its surroundings together, and then lined its cell with a flocculent white cocoon. In this it remained unchanged till the beginning of June when it went into chrysalis.

The pupa was of elegant shape, amber-coloured—the head parts darkening into brown. The antennæ and legs were traceable through the skin. The length of the pupa was three lines. The moths appeared in the end of June and continued till August. They mated about the middle of July.

The dimensions of the perfect insects were as follows :

Expanse of wings (male) 5½ lines, (female) 9 lines.

Length of body (male) 2½ lines, (female) 4 lines.

Length of antennæ (male) 2 lines, (female) 3 lines.

The eyes of the moth were large and prominent, in color they were a rich, warm brown. The palpi were reflexed—the second joint was long and had long scales, and the terminal joint was pointed. The antennæ were filiform, prettily encircled with minute, short bristles at the joints. The proboscis was long and coiled up, watch-spring fashion. The body terminated with a tuft like a paint brush. The tibia in the hindmost pair of legs had two pairs of spurs—that in the second pair, had but one pair of spurs.

The fore-wings were of a pale sienna brown, with a patch of darker brown extending along the costa and towards the inner margin, for two-thirds of the length of the wing. There were three or four lines of darker scales towards the hind margin and following its curve. Some of the specimens had the three dots on the disk spoken of by Stainton (*Man. of Br. Butt. and Moths*, vol. II, p. 348.) The hind wings were slate-coloured and had long fringes of the same hue.

The eggs of the moth (obtained by pressure) were very minute, globular, smooth and white. They are dropped probably into the flower head of the plant, for the most careful microscopical examination shewed no opening made by a larva through the glochidate involucre.

On August the 4th, I found the newly hatched larva biting into the side of one of the outer seeds. The seeds at this time were white and tender. The body of the larva was white, waxen, and semi-translucent.

The insects were identified for me by Lord Walsingham and Mr. J. H. Durrant. To them also I am indebted for the correction of the generic name from *Parasia* to *Metzneria*, Zeller.

It may well be asked, How was this European insect advanced to Canada? This probably is the correct answer: At Point Levi there is a quarantine station for cattle; and old country hay and straw are often landed with the cattle; and burs containing larva of the species have, at some time, been landed with the fodder. The Burdock is plentiful on all our roads.

The "Kissing Bug."

One of the strange occurrences that marked the season was the spread of the "newspaper scare" of the so called "Kissing Bug." The rumour concerning this fabulous insect took its rise in the United States, and was echoed by our Canadian press. All over the country alarming reports were published till the women were afraid to open their bedroom windows lest the bug should gain admittance. At the time that the fever was at its height, an employee of the G. T. R. company residing at South Quebec, took his family for a trip to the Island of Orleans. The day was hot and the man lay down in the shade for a nap. While he slept something bit him—probably a mosquito or a cattle fly. In his efforts to allay the irritation occasioned by the bite, he enlarged the wound. A day or two afterwards his arm began to swell, and he became seriously ill. Herein was confirmation of the kissing-bug reports! The part of the story that was not generally known was, that the day after he was bitten the man assisted in unloading a car full of raw hides for the tanners, and that it was the corrupting animal matter from the hides that had poisoned the wound.

About this time I came upon a group of excited people at a street corner in Quebec. I looked over the shoulders of the crowd and saw a negro who was exhibiting a very fine specimen of *Sphinx Chersis* as the veritable bug. "And this," said he, drawing out its proboscis with a tooth-pick, "is the instrument that it kisses with." A shudder passed through his auditors as they thought of the deadly effects of a thrust from this long osculatory weapon into the soft cheek of Sleeping Beauty.

INJURIOUS INSECTS IN ONTARIO DURING 1899.

By Dr. James Fletcher, Dominion Entomologist, Ottawa.

A few different kinds of injurious insects have attracted more than usual notice during the past season from the farmers and fruit-growers of the province. The keen interest which has been taken in the spread of the San Jose Scale has been at least enough to satisfy even Entomologists, who have been for three years begging fruit growers to believe that the San Jose Scale is not as was claimed, "only an ordinary insect like the Colorado potato beetle and many others." Unfortunately this conviction may have come too late, and the very men who ought to have been seconding the wise efforts of the Government to conquer this enemy by adopting promptly the measures recommended which would have prevented its spreading, are now claiming that the infestation is so widespread that there is no chance of eradicating it and that therefore the Government must stop all extreme measures. This matter has been discussed at length on previous pages of this report so that it is unnecessary to say here more than that the San Jose Scale is still to be considered one of the very worst enemies that the fruit grower has ever had to fight against, that there is no cheap and easy method of controlling it and that fruit growers should make every effort to get suspicious scale insects found on their trees identified, and if these prove to be the San Jose Scale, do everything in their power to destroy them promptly.

Cereals.

Grain crops throughout the province have not been injured to any large extent by insects. The Wheat Jointworm, which last year did some damage, has not re-occurred, and the same satisfactory report may be made with regard to the outbreak of the Wheat Midge, which appeared last year along the shore of Lake Ontario in the Niagara peninsula. The Hessian Fly, that old time enemy of the wheat grower, was rather more abundant than usual in Western Ontario, and letters were received asking as to the best way of preventing loss. Wireworms were troublesome in several places, and some practical treatment to prevent loss by these insects is much needed.

The Pea Weevil has done much harm this year. Farmers and pea growers are careless about getting their seed fumigated, and there are many complaints that this serious pest is increasing. In our last report, at page 78, full instructions were given as to the easiest and best means of treating seed pease to destroy the weevils. They were briefly: (1) fumigating the seed with bisulphide of carbon, or (2) the holding over of seed for a year.

The Destructive Pea Aphis (*Nectarophora destructor*, Jnsn.).—By far the most serious attack upon field and garden peas during the past summer was by a previously undescribed species of plant-louse. It is very remarkable that a species should suddenly appear, as this one did, in sufficient numbers to destroy millions of dollars worth of produce in a few days, and that it should have been previously so rare as to have entirely escaped detection and description by Entomologists. Such, however, was the case. The Destructive Pea Aphis occurred in vast numbers in several parts of Canada and the United States. Specimens of the insect and reports of its ravages were received from widely separated places, in a line extending from the Maritime Provinces to the Lake Erie counties of western Ontario, and from the Great Lakes down to the Southern States. The species has been worked up and described by Prof. W. G. Johnson, of College Park, Md., and an interesting account of it by him was read at the eleventh annual meeting of the Association of Economic Entomologists last August which will appear in the report of that meeting. Prof. Johnson said "the growing of peas in Maryland is a very important industry, and reliable conservative authorities place the loss this season at $3,000,000. the principal cause being the Pea Louse. In many cases the destruction was complete, varying from mere garden patches to hundreds of acres." The States in which most injury has been recorded are Maryland, Virginia, North Carolina, Pennsylvania, New York, New Jersey and Delaware.

The two most notable occurrences of the Pea Aphis in Ontario were at Freeman, reported by Mr. G. E. Fisher with specimens, and at Ottawa where the insects were found in large numbers from August until the end of October. The attacks upon field peas at Ottawa were unimportant, but the sweet peas in some gardens were seriously injured. For field peas it is difficult to apply a remedy, owing to the way in which this crop covers the ground, but with Sweet peas, spraying with tobacco and soap wash (10 lbs. of native tobacco leaves and 2 lbs whale oil soap in 40 gallons of water) was found very effective. Many predaceous and parasitic insects were observed at work. On the Experimental Farm larvæ of Syrphus flies and Lace-winged flies were common and beetles and larvæ of the two Lady-bird beetles, *Coccinella 9-notata* Hbst and *Hippodamia convergens* Guer, were extremely abundant, as well as the hymenopterous parasite *Praon cerasaphis*, Fitch. In the garden of Mr. Collingwood Schrieber, in addition to the above, large numbers of a new species of Aphidius* were detected. Unfortunately both the Syrphus flies *S. ribesii*, Fab., and the nine spotted Ladybirds were attacked themselves by parasites; but nevertheless they reduced very materially the occurrence of the Pea Aphis. As well as the above-named, larvæ of a minute dipterous parasite (*Diplosis* ?) and a fungous parasite appeared in small numbers in all colonies of the aphis and doubtless played an important part in bringing down the numbers. The undue increase of the various kinds of plant lice seems to be particularly affected by meteorological conditions, and, as in the past there is no record of serious injury to the pea crop by these insects, there is every reason to hope that we shall not have another visitation similar to that of 1899 for some years.

* Since named *Aphidius Fletcheri* by Mr. Ashmead.

Fodder Crops.

There have been few complaints of injury to fodder crops during the past season, the usual occurrence of "silverstop" on grasses in old meadows was due to the depredations of small leaf-hoppers. Grasshoppers were destructive only in a few localities. In the Ottawa district a considerable quantity of the common red and mammoth clover was injured by the Smaller Clover weevil (*Phytonomus nigrirostris*, Fab.) just before flowering in June, but there was no recurrence noticed in the second crop, and as clover is not grown for seed in the district, the injury was unimportant. The clover-seed midge (*Cecidomyia leguminicola*, Lint.) occurred in Western Ontario; but less complaints than usual were received.

Root Crops and Vegetables.

The various Root Maggots, always so destructive, attacked turnips, onions and cabbages, and, although a certain amount of success was obtained from the use of carbolic applications and the Goff tar-paper disk, nothing new of value was elicited. Dr. W. Gilpin, of Brechin, reports some successful experiments with white-lead applied around the stems of cabbages at the time of setting out. A series of experiments with a diluted application of Jeye's fluid, watered along rows of onions and radishes once a week from the time they appeared above the ground, would indicate that this will prove a useful remedy. Cabbages and cauliflowers similarly treated were also much benefited by this application.

The Diamond-back moth (*Plutella cruciferarum*, Zell.). One of the remarkable attacks of the past season, which was widespread throughout the Province, was by the caterpillars of the Diamond back moth, and occurred upon turnips, rape, and cabbages of all kinds. The injury became noticeable during August, when white patches appeared upon the leaves. Fields of Swede turnips and rape were seen so seriously injured near Stittsville and Ottawa as to look quite white from a short distance, and the crops were materially reduced. The small active caterpillars swarmed upon the leaves, but were found to be attacked by the usual parasite (*Limneria parva*, Prov.). On walking through infested fields the small moths flew up in swarms. Upon the Central Experimental Farm Brussels sprouts were much injured, and rendered unfit for the market by the larvæ eating their way inside the nubs. The habits of the caterpillar render the successful application of remedies difficult; for the most part they work beneath the leaves, and at the slightest disturbance let themselves down by a silken thread. Remedies which have been used successfully are dry applications, containing Paris green and pyrethrum, or a kerosene emulsion spray; but all of these must be used promptly on the first appearance of the enemy.

Blister beetles (*Macrobasis unicolor*, Kirby) did some damage to potatoes in the north-western counties; but as usual their attacks were of short duration, and where spraying with Paris green was practised promptly little harm was done, The closely allied Oil beetle *Meloe Americanus* Leach was found by Mr. J. J. Sheil injuring potatoes at Ariel, Ont.

The Asparagus beetles (*Crioceris asparagi*, Linn.) and C. *12-punctatus*, Linn.) appeared for the first time in Canada during the past summer. The two species were about equally abundant, and were the cause of loss to asparagus growers at Queenston and other places in the Niagara peninsula. These two beetles have been spreading slowly through the United States for some years. The common Asparagus beetle was first noticed in America 40 years ago; but it was not until 1881 that the 12-spotted asparagus beetle made its appearance, when it was found at Baltimore, Md.

The two species are very unlike. The asparagus beetle is a narrow black beetle about ¼ of an inch in length, very prettily marked; the head, legs and antennæ are black, the thorax red and the wing cases are black, with six silvery white spots, and widely bordered round their edges with orange red. The marks on the wing covers have sometimes the appearance of a black cross, for which reason it has also been called in England, the Cross-bearer. The 12-spotted asparagus beetle is of about the same length as the above; but slightly wider, and has the whole body orange-red, with exception of the antennæ, the feet, the knees and 12 black spots on the wing covers—6 on each. As a rule, the latter is

less abundant than the former. The habits of the two species are very similar; but differ in some very important particulars. Those of the common Asparagus beetle are best known. It passes the winter as a perfect beetle, and appears early in the spring, eating into the young shoots when ready for the market, and laying its eggs upon them. These eggs are black and elongated. They stick out conspicuously in every direction from the shoots upon which they are laid. The grubs soon hatch, and are slimy greyish-looking slugs with dark dots, a blackish head and black legs. They frequently do a great deal of harm to young plants. There are two or three broods in a season, and they not only feed on the young shoots, but upon the old foliage of the asparagus. In the case of the 12-spotted species the grubs also live inside the berries. Among the remedies which have proved more or less successful the following may be mentioned: (1) The beating of the beetles and grubs from the plants into nets or broad pans, containing water and coal oil. When collected in nets the insects must be killed by throwing them into scalding water, or water with a little coal oil on the surface; (2) Keeping the beds closely cut in spring, so that no eggs are allowed to be hatched, a few stems are sometimes left for the females to lay their eggs upon. These are subsequently cut and destroyed and other shoots are left to take their place as traps; (3) Spraying the beds at short intervals during the summer with Paris green and water, 1 lb. in 100 gallons of water, will destroy both the larvæ and the beetles; (4) Dusting with lime. It has been found that freshly slaked lime is very fatal to the slimy larvæ, and dusting the beds at short intervals of three or four days is one of the best means of clearing them of the larvæ; (5) The larvæ may also be brushed off the plants with a stick, and if this is done in the middle of a hot day it is claimed that few of them ever get back again, a short time on the hot soil proving fatal.

Fruits.

The San José Scale investigations have been the means of drawing the attention of fruit-growers to many insects which otherwise would have remained unnoticed, and although no new enemies have to be recorded as having done widespread or serious harm during the summer of 1899, most of the regular pests have been observed. Closely resembling the San Jose Scale are three other species, the occurrence and range of which are now much better known, viz., *Aspidiotus Ancylus*, Putnm., *A. Forbesi*, Jnsn., and A. *ostreæformis*, Curt. The last named of these, a European species, was first discovered in America at Chilliwhach in British Columbia; but it is now known to be present in considerable numbers in many parts of Western Ontario and in the Eastern United States. It most closely resembles *A. ancylus*, and has been, doubtless, confounded with that species in the past. Among remedies for scale insects spraying with whale-oil soap seems to be one of the most effective. Kerosene applied in various forms is also very useful. The application of Bordeaux mixture, consisting of sulphate of copper and lime in water, as a remedy for fungous diseases has also been found to be useful against scale insects by rendering the new wood, it is thought, disagreeable to the young bark-lice when seeking for a suitable place to attach themselves to the tree. Some experiments made by Mr. W. T. Macoun, the Horticulturist at the Experimental Farm, in spraying trees with whitewash to retard the opening of buds in spring, seems to add confirmation to this theory. Trees sprayed early last spring with whitewash are certainly freer from oyster-shell bark-lice than others not so treated.

Tent caterpillars were again this year very numerous and destructive in many parts of the Province, notwithstanding an abundant presence of parasites and a bacterial disease which killed thousands of the larvæ. Early spraying, as soon as possible after the young larvæ hatch, with Paris green, 1 lb. in 100 gallons of water to which is added 1 lb. of fresh lime, is quite effective; but if the spraying is delayed until the caterpillars become nearly full grown, they are much more difficult to kill. The egg-masses should always be sought for carefully during the winter and burnt, and a sharp lookout should be kept at the time the young caterpillars hatch so that they may be destroyed when they gather together in clusters after feeding, either in a web or in the case of the Forest Tent caterpillars on the side of a branch.

Among fruit pests of lesser importance which have been reported during the past summer in Ontario the following may be referred to: The Apple Aphis at Meritton, the

Plum Aphis at Dresden, the Pear-leaf Blister Mite at several places, the New York Plum Scale at four different points, the Pistol Casebearer of the apple at Cobourg and Valentia, Pear-tree Psylla at Winona, and an interesting injury to young plums while green by the caterpillars of the Streaked Hair-streak butterfly reported by Mr. W. M. Orr from Winona.

Of rather greater importance and wider extent than the above were injuries by the Currant Aphis, the Imported Gooseberry Saw-fly, the Pear Slug and the Eye-spotted Bud Moth. Mr. J. Van Horn sent specimens of the Fruit Bark Beetle (*Scolytus rugulosus* Ratz) from Chatham. This was first recorded as occurring in Canadian orchards last year.

Greenhouse Pests.

Under this head two new enemies have to be reported. Both were found in the extensive houses of Mr. J. H. Dunlop in Toronto. The Black Violet Aphis (*Drepanosiphum violæ* Pergande), which has been referred to from time to time in United States publications, was found in some abundance. As an aphis this is a beautiful species, although destructive where it occurs in numbers. It has been treated of in a special bulletin (Circular No. 37, Second Series) issued by the U. S. Division of Entomology, where the value of fumigating with hydrocyanic acid gas in greenhouses and cold frames is shown. While testifying to the effectiveness of the common remedy of fumigating with tobacco, it is pointed out that it requires repeated use at short intervals, and that it may even "cause serious injury to plants. In the case of violets, it has been found to be only of slight value against plant lice working in the bud, and, while it may destroy the so-called green aphis when exposed, it is not effective in killing the black aphis. Moreover, tobacco may prove injurious to the foliage and flowers, bringing on epidemics of 'spot.' Tobacco is also useless against scale insects in general and mealy bugs." The bulletin quoted from, is of very great value to horticulturists and others who grow plants under glass, but particularly to violet-growers. Violets are an expensive crop to grow, and this bulletin is the record of experiments which were specially undertaken to overcome the difficulties of treating violets under glass. Full particulars are given as to the methods of applying the remedy and the strength of gas to be used for various crops. The following quotation will illustrate the value of this pamphlet :

"Double English Violets—'Marie Louise,' 'Lady Campbell' and others. For plant lice and general fumigation fifteen-hundredths of a gram of 98 per cent. cyanide of potash for each cubic foot of space is required. The exposure, if made according to directions, will not hurt the plants in any stage of growth. The gas has been used on a large scale in fumigating violets for the past three years with the greatest success, only a few treatments during the season being required. Leaf-eating larvæ, slugs, millipedes, cut-worms, etc., when exposed are killed as well as plant lice. Red spiders, however, are not entirely eradicated by the treament. The foliage of single violets like California and Princess of Wales are sometimes slightly injured by the stronger dose of gas. A weaker dose (one-tenth of a gram potassium cyanide per cubic foot) should be used when they are to be treated.

"Other Plants.—Other plants on which the gas has been tried on a small scale indicate that it may probably have quite a wide range of usefulness."

The other new pest is the caterpillar of a small moth, *Phlyctænia ferrugalis*, Hbn. This is a very slender leaf-eating caterpillar when full grown, about three-quarters of an inch in length. It is of a semi-translucent green in colour, with a double white band on each side of the dorsal vessel and two distinct black spots on the second segment. The head is white clouded on the cheeks with brown When at rest the caterpillar has the habit of curling the head and the first two or three segments round at the side of the body. These caterpillars have done a good deal of harm in Mr. Dunlop's rose houses, and he complains of their working all through the season. The injury seems to be done chiefly by eating the parenchyma from the lower sides of the leaves. The specimens bred from Mr. Dunlop's material were kindly identified by Prof. C. H. Fernald, who also referred me to the article in the Michigan Experiment Station Bulletin, No. 102, by Mr. G. C

Davis, who treats of it as an enemy of celery, in which plant it is said to both bore into the stems, channelling at the base of the leaf stalks and leaving nothing but a shell on the outer side, and also feeds on the leaves, the larvæ being found either rolled up or sewed in between them. Mr. Davis states that Prof. Fernald had written to him that "to his knowledge the species had never been bred in this country before. In an English periodical, Entomologists Monthly Magazine, vol. 14, pages 200-4, all the early stages are fully described. The species was bred on the leaves of Boneset (*Eupatorium*), and was also taken on Hedge Nettle (*Stachys*) and strawberry leaves. It is thought to be two or more brooded."

SOME OBSERVATIONS ON A BUMBLE-BEES' NEST.

By Rev. C. J. S. Bethune, London, Ont.

In the Head Master's garden at Trinity College School, Port Hope, I had planted a clematis in the angle formed by some stone steps and the brick wall of the chapel organ-chamber. In the spring of 1897 I put some cut grass from the lawn at the base of the plant to serve as a mulch and keep the ground moist about the roots. A gravelled walk ran parallel to the building at a distance of about a yard, with a branch at right angles to the stone steps; between the clematis and the walk there was a densely growing young lilac tree. The creeper grew with great rapidity and I found it necessary to support it with wire netting. One day when putting this up, I noticed that whenever I touched the cut grass there came from it an ominous bizz-z-z. I thought it was only a Queen Bee looking for a deserted mouse's nest, but subsequently discovered that the "bizz" was always there when I poked the grass. Later on the worker bees were to be seen coming and going, and there was always a sturdy sentinel at the entrance to the nest. My man-servant, who did not by any means share in my interest in all things entomological, wanted very much to destroy the nest as he was afraid of being stung by my friends the bumble-bees, but I would not allow him to do so. He then tried to drown them out when watering the lawn with the hose, so I protected them with a slanting piece of slate, which left a space between the top of the nest and its new roof.

One day in the middle of summer I dropped some bits of cut grass beside the slate, and found that the bees soon carried them off inside; I then gave them more and watched to see what they would do with it. Two of them apparently attended to this work, and they were most industrious, never seeming to stop throughout a long summer's day. The outside bee would run about, seize a bit of grass and pass it swiftly between his legs, under the length of his body, backwards,—and then another, and so on, till he got it all near the opening at the end of the slate—the end opposite to that at which the family went in and out. He then began again at the little pile that he had collected, and passed the bits of grass in to his companion under the slate—always sending them between his legs backwards. It was most interesting to watch the operation, and I paid frequent visits to the nest during the day to see how it was going on. After a time that opening was pretty well filled up with grass and the workmen took a rest.

Though bumble-bees were visiting the flowers close by until late in October, I very rarely saw one go in or out of my nest after the middle of September, and felt strongly inclined to think that my man must have drowned out a good many of the colony. He never neglected to water that clematis! I was quite grieved when one day I found my friend the door-keeper dead just outside the entrance, where he had so faithfully done his duty during many long summer's days. This was after some chilly nights, when there had been a slight touch of frost.

Towards the end of November, long after any bumble-bees were to be seen in the garden, I dug up the nest in order to send it to Dr. Fletcher, who wished to see whether there were any parasites affecting the bees. I found that the bees had done a good deal of excavation and gradually hollowed out the place for the nest till they had sunk it so that the top was level with the soil—it was started originally on the surface. They must have dug a hole at least three inches deep the whole size of the nest. The earth

was brought out in pellets and formed into a neat little embankment, or causeway, against the wall, leading away from the entrance. They were a very orderly and peaceable family, and never annoyed any one, though passers-by were frequent along the gravel path not a yard away, and up and down the stone steps at the end of the nest.

It cannot be too often repeated that bumble-bees are decidedly useful insects, and do much good work for farmers and fruit-growers. Their hairy bodies are specially adapted for carrying pollen from one blossom to another, and thus they are instrumental in fertilizing many varieties of fruit-trees, melons, cucumbers, pumpkins, etc., clover, red and white, and various flowers, many of which would be unable to produce any seeds but for the kindly offices of bees.

THE NORTH-WEST (CANADA) ENTOMOLOGICAL SOCIETY.

The First Annual Meeting of the North-West (Canada) Entomological Society was held at Lacombe, Alberta, N.W.T., in the Agricultural Hall on Tuesday, the 7th November, 1899. At the request of the President, the chair was taken by Griffin Fletcher, Esq., J.P.

Agriculturists were well represented. The minutes of the last ordinary meeting were read and approved. Letters were read from Mr. J. A. Guignard (in the absence of Dr. James Fletcher); Dr. L. O. Howard, of Washington; the Bishop of Calgary and Saskatchewan: Dr. Sanson, of Banff; F. Oliver. Esq., of Edmonton, M.P., and a very large number of other gentlemen interested in the work of the Society, expressing full sympathy with its objects.

The Chairman, in a few opening words, explained that the object of the meeting was to popularise the Society amongst farmers, by showing the use of Entomology and Botany, and that a number of gentlemen had written special letters with advice, which would be read after the addresses on the agenda had been delivered.

The Chairman then called upon the President, Mr. Percy B. Gregson, to address the meeting. (See page 114).

The President then read an address by the Revd. C. J. S. Bethune, D.C.L., upon "The Use of Entomology."

An address from Mr. H. H. Lyman, M.A., (the President of the Entomological Society of Ontario), was next read.

The suggestion in Mr. Lyman's address as to affiliation of the North-West Entomological Society was discussed, and it was decided that at present affiliation was impracticable, owing to the somewhat original course adopted by the North-West Society, (of which details appear in the Report of Council).

An address by Dr. Henry George, M.R.C.S. (Eng.), of Innisfail, Alta., on "The Pocket-Gopher," (G. bursarius) was next read by the President.

Numerous letters in support of the President's course of procedure were next read from members of the Society, among them being a letter from The Bishop of Calgary, in which His Lordship (after remarks as to the uphill work before the Society) advised quarterly meetings, to which the public should be specially invited; a letter from Mr. E. Firmstone Heath cordially supporting the President's project of giving sketches of insect life to the school children and parents, and of holding quarterly meetings for interchange of experiences; from Mr. A. W. Hanham, Mr. F. Oliver, M.P., Dr. N. B. Sanson, of Banff, Alta., and several other gentlemen to the same effect.

Mr. Hanham and Dr. Sanson suggested the formation of a "Naturalists' Club," but, in view of the scattered community, it was decided to be impracticable at present; but that a suggestion by Mr. Heath that some kind of Natural History Periodical might be published eventually by the Society, which would be circulated among the public, should be seriously considered at the earliest opportunity.

A letter from Mr. C. W. Peterson Deputy Commissioner of Agriculture, Regina, was then read, in which he remarked among other things upon the importance of investigations into the insect life of the country, and mentioned an estimate of damage done by insects to crops of the United States at $300,000,000 per annum, and concluded with expressions of the Commissioner's appreciation of the President's efforts to create an interest in Entomological and Botanical matters in Alberta and the Territories.

A letter from Dr. L. O. Howard was also read, in which, after wishing success to the President's work, Dr. Howard remarked that though the actual value of this class of work could not fairly be reckoned in dollars and cents, yet that there was no doubt that hundreds of thousands of dollars were saved to the farmers of the United States every year by the carrying out of the recommendations of the State Entomologists. Dr. Howard also, in approving of the encouragement of nature study in the local schools, advised the display of insects characteristic to the locality.

The Chairman then read the Report of Council.

The election of fresh members then took place; and the election of officers for the ensuing year; Percy B. Gregson remaining President of the Society.

The Rev. Matthew White, of Lacombe, was elected Vice-President: Arthur D. Gregson, J. P., of Waghorn, the Librarian-Curator; Percy B. Gregson, the Secretary-Treasurer; and the Rev. J. Hinchliffe of Red Deer, Alta.; William Wenman of Red Deer; T. N. Willing of Olds; and F. H. Wolley-Dod of Calgary, as Members of Council.

Before conclusion of proceedings, Mr. C. T. Daykin announced to the meeting that the President had already arranged to give every month at the Waghorn School-house a short sketch on the life of some insect, or of some other phase of nature, and its economic value, and the date would be published in newspapers in time for every one to attend, and the sketches would interest not only the young folk but "grown ups."

The Chairman then read a letter just received by the President from Mr. Arthur G. Wolley-Dod (Vice-President of the Calgary, and Secretary of the Fish Creek, Agricultural Societies), requesting the President to prepare a short treatise on insects and their value as regards agriculture, which he could read at the forthcoming Agricultural Societies' annual meetings in December.

The Secretary of the Lacombe Agricultural Society also requested a paper by the President for reading at the December annual meeting of the Lacombe Agricultural Society.

After a vote of thanks to the Chairman, the proceedings terminated.

Report of Council.

In submitting its First Annual Report, the Council take the opportunity of recording their sincere expressions of gratitude to the many gentlemen high in the Entomological and Agricultural worlds for their sympathy—their actual co-operation—with the work of the North-west (Canac Entomological Society. The Society has embarked in an enterprise in a distant and comparatively unknown land, whose settlers are pioneers and from many parts of the globe, and untutored; and the advantage to the Council in having advice from such men as the Founders of the Entomological Society of Ontario, Dr. James Fletcher, Dr. L. O. Howard, and Mr. C. W. Peterson, cannot be overvalued.

The Society's Collection of Insects has been greatly augmented by gifts from Dr. Sanson, of Banff; Dr. Herman Strecker, of Reading, Pa.; and Dr. Henry Skinner; and other gentlemen, including Messrs. W. Wenman, E. F. Heath, T. N. Willing, H. Hutchinson, A. W. Hanham, and A. J. Dennis have kindly promised examples representative of their respective districts. The Society's Collections are always on view to the public.

Mr. E. Baynes Reed, the Rev. Dr. Bethune and Prof. James have presented to the President the entire set of Reports of the Entomological Society of Ontario. Dr. James Fletcher, a full set of his Reports since the establishment of the Ottawa Experimental

Farm ; Dr. Howard, a large number of Reports and publications of great value (bound and unbound) from his Department ; and to these the President of the North-West Entomological Society has added a number of other works on Entomology, Botany, and Geology.

The Council, noting the large influx of immigrants into Alberta from all lands (Swedes, Bohemians, Galicians, Russians, Norwegians, etc.), realises their great need for a right apprehension of the value of economic entomology.

The Council begs to tender the reason for the absence of a balance-sheet and statement of expenditure :—In founding the Society the President elected to defray every expense, until its objects should have become appreciated, and a course of procedure formulated. The kind recognition of the value of such a Society in the North West, coupled with much practical advice, has made the way the President should pursue clear and defined, and a way which has received the fullest approval. Pursuing strictly this course, the President of the Society purposes to give a monthly sketch in the local Public Schools before the children and their parents on insect life or other phase of nature and its economic value; and to call quarterly meetings at different points of the members of the Society, to which the public will be specially invited, for interchange of experiences, etc., and receiving accounts of new insects and weeds ; and to submit short papers for reading and discussion at the meetings of local Agricultural Societies.

Presented on behalf of the Council.

PERCY B. GREGSON,

7th November, 1899. Secretary-Treasurer.

ADDRESS BY PRESIDENT OF N. W. ENTOMOLOGICAL SOCIETY

Ladies and Gentlemen, and members of the North West Entomological Society :

A year ago a few of the members of this district felt that the time had come when the insects of this great North-West should receive more attention. With the spread of immigration "bugs" and "grubs" of various sorts had also spread westward, and the greater part of the country itself was practically unexplored, as far as insect or plant life was concerned.

We met, therefore—a few of us—and the outcome of the meeting was the formation of the North-West (Canada) Entomological Society. We have been exceptionally favoured in having the sympathy and advice of men of large experience and influence : I allude to Dr. James Fletcher, the Dominion Entomologist ; to Prof. James, Deputy Minister of Agriculture for Ontario : to Mr. C. W. Peterson, our own Deputy Minister of Agriculture ; the Bishop of Calgary ; Mr. Oliver, M.P. ; Mr. Simpson, M.L.A. ; Mr. E. Baynes Reed, the Government Meteorologist at Victoria ; the Reverend Dr. Bethune, Editor of the Canadian Entomologist ; the Reverend G. W. Taylor, Government Entomologist for British Columbia ; Mr. H. H. Lyman, President of the Entomological Society of Ontario ; Mr. Young, Editor of the Calgary Herald ; Dr. Herman Strecker, and many other gentlemen (all of whom are members of the Society). By the generous gifts of Mr. Reed, Dr. Fletcher, Dr. Bethune, Prof. James and Dr. L. O. Howard of Washington (The Government Entomologist for the United States) a nucleus for a good library has been formed. Other gentlemen, including Dr. Sanson, of Banff, Mr. T. N. Willing, and Mr. E. Firmstone Heath of Manitoba, have donated insects, and we owe to the generosity of Mr. Edmond a serviceable working microscope.

So much for the introduction of the Society, but before proceeding to the object for which this meeting has been called, I wish to publicly and most sincerely thank the number of gentlemen who have been so kind as to write, with assurances of their continued support and sympathy with my efforts, while regretting their inability to attend this meeting. These letters will be read presently.

We now come to the objects of this meeting, and I am very heartily glad to see so large a gathering. The question I am most frequently asked in connection with this

society is; What is the use of it? This is a practical age, and farmers cannot afford to look at anything they have no use for. Now, an entomological society is simply another name for a society of persons who are making some sort of observations about insects—not merely butterflies—but grubs, bugs, worms etc., and the points I wish to show are, that some knowledge of insects is very important to all of us who are engaged in agriculture, so that we may rightly distinguish between our insect friends and our insect foes; and some knowledge of insects is also necessary in order that the farmer may know how to deal with his insect foes, and how to make the most of his insect friends.

Now to see how to deal with insect foes, we must first of all learn something about them; there are many, like the Hessian Fly, whose grubs do all the harm and many others, who themselves as well as their grubs do the harm, like the Colorado Beetle. Insects that themselves do harm, do so by mouths that bite or mouths that only suck. Those that bite have jaws, with which they bite off solid pieces of food from the plants or annimals they attack. Some poisonous material must therefore be placed *on their food*, so that when this food is eaten by the insects they may be destroyed by the poison. Those insects that suck, have no jaws, but sharp hollow beaks through which they suck the juice of the plants or blood of the animals they attack. For sucking Insects it is therefore useless to place poison on the plants, because, having no jaws, they only feed on liquids such as juice or blood, for which they have to sink their beak-like tubes beneath the surface of the object attacked. For this class of insects, substances, which kill by coming into contact with the bodies must be used, e.g., kerosene and soap emulsion, or oils, which stops up the breathing organs, The losses in agricultural products from insects and their grubs is reckoned at fully ten per cent.

A few of our common insect foes in this country are pretty well known. There is the red turnip beetle, which destroys our Swede turnips [example of Entomoscelis adonidis Fab, produced and handed round] The little turnip "fly" which destroys the young turnips when in first "leaf". These "flies" are really little beetles, and, like all beetles, pass through the grub and chrysalis stage, so that if we learn the probable date for hatching (for all insects are very regular) we shall know when to sow the turnip seed—They should be sown either sooner than the beetle hatches, so as to get their second or third rough leaf before it hatches. or they should be sown so much later than the hatching time so that when the "flies" hatch they have to starve. And we must now, it seems, look out for the Colorado beetle, or potato bug. It has appeared in two or three places in Alberta this summer, and last year was injurious in several parts of Manitoba. The red turnip beetle is sometimes mistaken for it, but the potato bug has ten stripes altogether, and the red turnip beetle has only three, but both are destroyed by the same treatment (Paris green solution).

Now, all the insects I have mentioned have jaws, so that they are "biting" insects, and the remedy against them is to sprinkle poison on their food.

Then there are the grubs that work underground or at the surface of the soil. We all known the garden "cut-worm". This is a caterpillar, which eventually developes into a very common moth that flies about our lamps and windows in the fall, and which is easily caught and destroyed. When in the "grub" stage, it is very destructive to our young cabbages and other young plants. It lodges during the day just under the soil—you can find it in the mornings by the small hole it leaves in the ground near the plant it has attacked over night. They come out only at night, and then they nibble through the small stem of the plant, and sometimes draw the leaf down into the soil to consume at leisure. Now these grubs are very fond of bran, so that a little damp bran with a very small quantity of dry Paris green stirred in (proportions 50 to 1) will be sure to destroy them, or wrap paper round your cabbages when you plant them out. Another very common grub in our potato patches is the wire-worm. These are a nuisance in the way they work into our best potatoes The wire-worm lives in the ground through the winter, and in the spring, after going through one more stage (pupa), develops into a small brown or black beetle, called a "click" beetle, because when the beetle is touched it gives a quick spring away. These beetles we should learn to recognize as our foes, and should kill them all on sight, because it is from their eggs that the next crop of

wire-worms will come. And so we see that by knowing the life history of these things we get a double shot at them. We kill the worm, and we also know its parent, the "click" beetle, and kill it.

Among the *sucking* insects are various kinds of lice. They have only long beaks, for sucking, but no jaws. We find them on animals and plants, and as they get their food by sinking their beaks (which are as sharp as a very fine needle) through the surface, any amount of poison on the surface will not kill them, so the way to attack them is by something that will stop up their breathing organs and suffocate them, *e. g.*, coal oil emulsion, tobacco decoction or smoke. And so there are many other insects which we soon learn to recognize as foes, and by knowing their habits and how and when they breed, we can learn how to deal with them. There are foes all around, grubs eating our poplar and other trees, our fence posts, spruce trees, etc.

To come now to our insect friends. We have many among our ordinary beetles, and whenever we recognise any of our friends among them we should be careful not to destroy them. In our gardens and fields there is a beetle called the "fiery" beetle, which has six rows of bright bronze spots on each wing cover. This insect in two of its stages (grub and beetle) feeds on the cutworm and wireworm. It attacks the cutworm so eagerly that it is often called the "cut worm lion beetle." [Specimen of Calosoma calidum, Fab., handed round]. Then there is a smaller beetle (black) called the "ground beetle," which also feeds on cutworms, etc. [Specimen of Harpalus caliginosus, Fab., handed round]. The "tiger" beetle is also a great friend of ours in that way. [Example of Cicindela vulgaris, Say, handed round]. And the familiar little "lady-bird" (of which there are several varieties) lives on nothing else but our insect foes. It's "grub" devours wholesale the young plant lice and the young of turnips and potato bugs. Wasps, too, are among our insect friends and all "dragon flies." Besides these and many other of our friends which we can see every day, there is a host of minute flies, whose grubs feed upon our enemies and should not be recklessly destroyed.

A good general agricultural remedy is summer fallowing, as it starves the insects, and exposes them to birds, etc. You might try a small patch next year, and see the effect. Then late fall plowing will turn up to the frost and so destroy hundreds of wireworms and other grubs. We have also many friends among our common birds, such as jays, crows, and all sorts of wood-peckers. Wood-peckers never attack a tree, either dead or alive, unless there are grubs first eating the tree, and it is to get at these that they peck the trees at all. Their long tongue works into all the cracks of bark, etc. And this year there has been an unusual number of toads. Toads do no harm and feed almost entirely upon insects, and should be carefully protected accordingly.

Among our enemies too is "smut," though this is really a fungus. This is a fungus on grains, and, while always a pest, is rather more prevalent this wet year than usual. The bad features of "smut" are that it lowers the standard of purity in the flour, and it takes away from the profit of the crop. A deduction of 8 p.c. is a fair estimate of the loss from smut alone to the farmer, and the worst of it is a "smutty" plant does not thin out the stand and give the healthy plants more light and soil. It takes up just as much room, and requires as much nourishment and moisture from the soil as do the healthy ones. One single germ of smut coming in contact with a healthy grain will infect it, and smut germs are easily blown about by the wind, or carried from field to field by threshing machines.*

It often seems strange that there should be in the ground so many cutworms and other grubs, but this would not be the case if the land were kept perfectly clear of weeds. Weeds, such as Lamb's quarter, are their natural food, and where these grow the insects naturally go in order to lay their eggs, which hatch into the grubs.

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*Note—In answer to several enquiries at the meeting as to the remedies to prevent smut, I gave the general formula advised by Dr. Fletcher in ordinary cases, viz. : Dissolve 1 lb. of bluestone in a quart of hot water, which is then sprinkled by one person over 10 bushels of wheat or barley, placed in a wagon-box, whilst some one else keeps the grain well stirred. Oats should be *submerged*, not sprinkled only.

There has this year appeared among us for the first time a tiny grey "plume" moth, whose larva is very destructive to clothes, furs, sacking, etc., and whose presence in this country can only be accounted for by coming with outfits of new settlers.† It will be interesting to see if it reappears next year. The moth is in great abundance, and if its eggs hatch next spring, it will become a troublesome household pest, and we can only hope that a dry year will exterminate it. We know that many insects and the grubs of others stand extreme degrees of cold. In this North-West they often endure 50 or 60 below zero without injury, so that we cannot rely on winter to destroy them. If they reappear, we must be prepared with a remedy.

I thank you, Ladies and Gentlemen, for having heard me so patiently, and I come now to the suggestions I have to make. The large immigration that is being attracted to this country is in one respect a source of danger, because there is always a liability of any new settler inadvertently introducing a new weed, or a new insect, which may turn out to be a pest. We should therefore be on the watch, and that is one of the reasons why I have invited so many agriculturists to join an entomological society. I wish the heads of all our agricultural societies to become members, so that by personal intercourse, by correspondence and quarterly meetings (which I will try to hold at different points along the line), we can keep in constant touch with each other, and the presence of any troublesome or new insect or weed in any locality can at once be ascertained and kept under control before it becomes aggressive. We have already on our members' roll agriculturists scattered throughout Alberta and Manitoba, and on the roll are the Presidents or Secretaries of our own (Lacombe) Agricultural Society, and of that of Red Deer, Innisfail, Calgary and Fish Creek, and I hope soon members of other agricultural boards will join.

Many of our leading members wish the Society to issue a small periodical magazine, and it seems to me that we might do so every quarter. This magazine would, with other matters of interest to the farmer, mention new insects or weeds affecting us, and sketch the life history of some insect or animal or trace the progress and effect of some weed, or treat of some other phase of natural history, and be circulated in the country.

Another suggestion I have to make, which is, that the young folk of this country might be made to take an interest in the flowers and insects they see around. They would soon understand their value as affects agriculture. The young are the coming generation, and what they can learn now about these things will stand them in good stead when they are older. They will soon take a real interest in these things. It will be like a new world to them, a world peopled with hundreds of different forms, and every one of which will have a beauty and interest of its own. The powers of observation of our children would grow, and every spark of knowledge they gain of insects and plants would make them fitter men and women.

This brings me to the answer of the question with which I introduced this Society. The question I asked was:—"What is the use of an Entomological Society?" In mentioning certain insects I have alluded to certain remedies, and, though there are certain standard remedies now very well known, they are the outcome of many trials and experiments by people who study these things. In most instances of insect pests their entire life history has to be observed, and the various stages they pass through and their habits carefully investigated. And we must remember that although we ourselves may know how to deal with insects (both foes and friends), there are thousands of immigrants from foreign lands now settling around us who have never heard of any remedies against insects. There are Galicians, Russians, Finlanders, Swedes, and many others. These will have just the same insects to contend with as we have, and it is our privilege—even our duty—to see that they also are made acquainted with our tested remedies, and methods of dealing with them.

The Society is, however, not confined to the economic side of entomology and botany. It has been organized also to collect and investigate insects of various orders.

†Genus *Alucita*, Linn.

The field of its operations is very little known, and we hope that in course of time the society will be in possession of a collection of rarities from districts hitherto unexplored, which will be contributions to science. We hope, through our members, to extend our researches further north and north-west next year, and to gradually increase our field, and any discoveries made will be recorded in one common centre and published from time to time. There are very many boreal and arctic insects whose life histories are unknown, and these as far as possible the society will endeavour to work out. Of course at present we are a small body, but everything must have a beginning, and we hope and believe that, with loyal and earnest members, the Society we now are is but the nucleus of one which will be of much use both to science and to the Canadian farmer.

PERCY B. GREGSON,
President.

THE USE OF ENTOMOLOGY.

BY THE REV. DR. BETHUNE, LONDON, ONT.

Everyone interested in the cultivation of the soil, whether for profit or pleasure, every farmer, gardener and fruit-grower, will require but a short experience to convince him that he has a hard and never-ceasing battle to fight in order to reap a due reward from his labour. After he has duly prepared his ground and put in his crop, of whatever kind it may be, he is sure to find, before it comes to maturity, that there are many enemies who will try to rob him of a large portion of the fruits of his toil. Oftentimes there will be no visible token of their presence until the ingathering reveals a diminished or damaged return ; in other cases injury will be apparent, but the enemy who wrought the mischief cannot be seen, the mysterious foe is working by night, or contrives to hide himself so completely from observation that only the destructive results are apparent, while the culprit keeps out of sight.

It will readily be guessed that the enemies I refer to are injurious insects. Their name is legion and their numbers are as the sand of the sea shore. Every plant that grows, whether great or small, is liable to attack—it may be in the roots underground, in the stem or trunk, in the bark or wood, in bud or leaf or branch, in blossom, seed or fruit, and after the grain has been safely housed or the fruits and vegetables stored for the winter's food, there are still foes to be fought, insect enemies to be guarded against.

With such myriads of minute creatures to contend against, working in such diverse manners, the contest might seem a hopeless one, and indeed it would be were it not that nature has imposed her own limitations, and no single insect foe is long allowed to pursue its way unchecked. Where we have to deal with species native to the country, we may feel sure that however much the injurious kind has been allowed to multiply and spread, it will not be long before the balance is restored and the damages reduced to an average amount. But when we are invaded by species introduced from a far distant land, especially those brought from across the seas, the case is usually very different. The enemy arrives in our midst, unaccompanied by the predaceous insects, parasites or diseases that keep down his numbers in his place of origin, and he rapidly increases and multiplies without let or hindrance, until artificial means are employed for his subjection. In such cases the farmer or fruit-grower may suddenly find himself confronted with a mischief worker whom he has never seen before, and with whom he has no idea how to wage a war. His plight may be a serious one, and his losses more than he can bear; he knows not what to do nor where to turn for relief. Hitherto, in Alberta, there has been no help at hand, but now we may rejoice that measures have been taken to give assistance and advice wherever they may be needed. The North-west (Canada) Entomolcgical Society has been organized mainly for the purpose of doing good to all the dwellers in the Territory who are employed in the cultivation of the soil. It is their business, and also their pleasure, to study the insects that dwell in the land, to trace out their life-histories, watch how they work, learn their habits, whether they are noxious or beneficial, or simply

beautiful, and then to study and experiment upon the best means of getting rid of the enemy and encouraging the friend. It will help on the cause very greatly if every farmer will take note of the insects affecting his crops and give all the information he can to the Society ; and also send specimens of both the creature and its work.

The entomologist does not pretend to a universal knowledge of insects, but he can usually tell at a glance whether a specimen belongs to a good or evil tribe, and if it should be new to him he can always apply to his correspondents in other parts of the continent for the information that they have been able to acquire. Science knows no political or geographical boundaries, and help may be sought and will be promptly and cheerfully given whether the application is made to the entomologist in charge at Ottawa or Washington. In your case you have the satisfaction of knowing that this department at Ottawa is in the hands of Dr. James Fletcher, who has often visited the North-West Territories and made himself familiar with the most important of your insect enemies. Should the local members be puzzled over some new importation or immigrant they may feel sure that any assistance they require can be obtained from Dr. Fletcher. But they do not by any means intend to be dependent upon one who is many hundreds of miles distant ; they mean to be up and doing for themselves and to spare no pains till they get toknow as much as they possibly can about the insects that infest the country round them.

The ordinary entomologist is often looked upon by his acquaintances as a somewhat silly person who devotes much of his time to chasing butterflies and searching for bugs and beetles, but this is work that has to be done. We must collect the insects in our neighborhood and study them before any progress can be made—we must find out their names and the families to which they belong before we can make use of the records and observations of others ; we must rear them through all their stages and watch their habits before we can be sure what remedies will be available against them. It is a vast, and endless work, one that may well engage a multitude of enthusiastic students and which should enlist the co-operation of every farmer and gardener in the land. Every one may help by keeping his eyes open and making known his observations to the members of the Society. Any unusual visitation of insects, whether as regards numbers or effects, should be at once reported, and the results of any experiments placed on record. Insects should by no means be ruthlessly destroyed unless in the form of caterpillars, grubs or plant lice, they are found in the act of devastation. There are many kinds that are really the farmer's best friends, and it would be a sad mistake to slay the benefactor with the wicked. This shows the necessity of a little knowledge of the subject ; every one, for instance, ought surely to know that a lady-bird is a most useful destroyer of plant-lice, and so, also, is a Syrphus and a lace-winged fly, and yet how few there are who would recognize the two latter if they saw them. A beginning ought to be made with the children. They take an instinctive delight, as a rule, in living creatures and are charmed to learn something about them. An hour a week at school devoted to the elements of entomology and botany in a practical form would be of untold benefit in the course of subsequent years.

I have only attempted in this paper to give a brief outline, in general terms, of some of the benefits to be derived from the study of entomology ; those who are on the spot can enter into details and discuss the special insects that are present causes of anxiety. I would only say further that entomology means money—means dollars and cents lost or saved to the farmer, fruit-grower and gardener. If the Hessian-fly has this year, as is reported, destroyed in some cases 25 per cent., and on the whole from 5 to 10 per cent. of the vast wheat crops of Manitoba, just think of the millions of dollars that that means ! What more useful work, then, can be undertaken than the effort to save at least a portion of this immense sum ? Entomology can do it, if the farmers will only believe it, and adopt the measures that its experience in other regions has proved to be effective. The expenditure on the part of the government of each Province or Territory of a few thousand dollars a year in securing the services of a trained entomologist and in disseminating broadcast the requisite information would enable the whole of the farming community to unite in an intelligent plan of campaign against the common foe and clear their fields of

the insidious pest. If a pack of wolves were to come down from the mountains and ravage the flock and herds of the community, carrying off and destroying one-tenth of the cattle and sheep, it would not be long before every man in the country who could fire a gun and ride a horse would be in hot haste to join in a fierce onslaught upon them. Why should there not be an equal effort and an equal determination to get rid of an insect enemy that causes the loss of just as great an amount of most valuable property? In the one case there is, to be sure, the instinctive love of the chase and all its attendant excitement, while in the other there is the humdrum adoption of some special date of ploughing, some particular variety of seed, some careful burning of stubble, some extra cleaning of grain,—perhaps some little expense, not for powder and shot, but for remedial applications.

There is another side, also, I am glad to learn, to the North-West Entomological Society. It is paying attention to practical Botany, and also to Geology. The latter, to the ears of most, conveys the word *gold*, and I need not, therefore, refer to the value of it,—but all I have said about the study of insects applies equally well to that of weeds. The one are as ubiquitous as the other, and it is quite evident that over the vast prairies of the North-West, with their rich soil and luxurious vegetation, weeds are going to prove as tough a problem as the worst of our insect foes. Here, too, all can do something—all can co-operate. No man should be permitted to let his neighbour's fields be sown with the seeds of weeds that he has been too lazy or too careless to cut down. But many weeds are blown for miles across the land and have to be dealt with in various ways. These are matters to be studied and objects upon which experiments must be tried,—and here, too, comes in the necessity of some education, some elementary information by means of which a noxious weed may be distinguished from a useful or a harmless plant.

I am writing from a long way off and to dwellers in a land that I have never seen, but in matters of science distance makes no difference. We are all brothers in search of truth. We are all at one in our desire to help each other in any way we can—to lessen the toil and cheer the labours of those who are preparing the way for a rich and prosperous community, a goodly province in the Empire of our Queen and the Confederacy of our Dominion.

ADDRESS BY DR. HENRY GEORGE, M.R.C.S., ENG., L.R.C.P.

Mr. President, ladies and gentlemen, and fellow members of the Northwest Entomological Society, I am glad to greet you. As long as I have been in Alberta—some ten years—I have looked forward to this time, when men are ready to use both brains and eyes, and not merely till the ground and perform various other labors in these almost wild parts of the world.

I take it that the chief object of this Society is to enable the farmer to distinguish between his friends and enemies, as relating to his crops, grasses, domestic herds, &c. Birds, animals, insects, weeds, are all under this head; and it behoves us to help our Secretary in his praiseworthy endeavor to make us understand and learn how to distinguish between what we should destroy as vermin and what we should protect as beneficial to the agricultural interests.

I may say that the love of observing nature has been born in me, and when I came out here and heard a man called a "bug hunter" I was much insulted, as I had never before connected that obnoxious word with anything except the little insect that disturbs night's slumbers in some cases. But I might bring these remarks to an end as the Secretary has kindly asked me to pick out some animal or bird and give you my observations and readings on the same. I am going to give you a few words on the

Pocket Gopher. (*G. bursarius*).

This animal is like the English mole in many respects, but differs in others. Like the mole it lives underground and throws up small heaps of fine earth, having "runs" under the ground. Its fur, both in texture and color, is very similar. It looks like a

large mouse ; is thick set, with a short tail, almost devoid of hair. Its claws are long for digging, but are not shaped like the mole's; also, its teeth are quite different, showing that they live on different diets. The pocket gopher is essentially a rodent, i.e., one of the gnawing animals, having the four inscisor teeth long and like chisels, whereas the mole has regular flesh-eating teeth, and is insectivorous chiefly in its diet. The reason this is called "pocket" gopher is because it has on each side of the mouth two pouches which are just like the fingers of a glove when turned inside out. They are outside the mouth, so that when filled have to be emptied by the forepaws which press out the contents. These animals are more destructive than useful, and though I have no doubt that they kill many insects yet they chiefly live on roots of grass, grain, &c., also are fond of potatoes, carrots, and most of the farmer's root crops. They chiefly come up from the ground in the twilight and form one of the chief foods of the long-eared and short-eared owls. I have seen them in the day-time but rarely. I understand that one of the best ways of catching them is by putting a trap in the "run" between two heaps of earth. This is one of the farmer's foes and wants destroying. It's heaps of earth are unsightly, and do harm in covering up grain and seeds too deep; their "runs" take away earth from the roots of grass, grain and shrubs, and lastly they eat and destroy root crops.

With many thanks for listening to these few words, I must conclude; but I hope to see this Society progress and take its place as one of the first scientific societies in the great North-west of Canada.

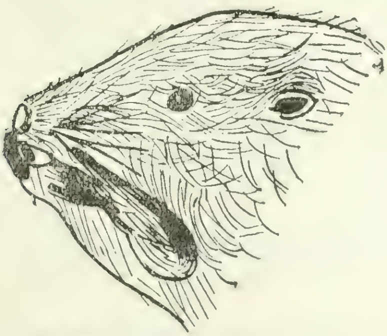

FIG. 65.—Head of Pocket Gopher. Life size.

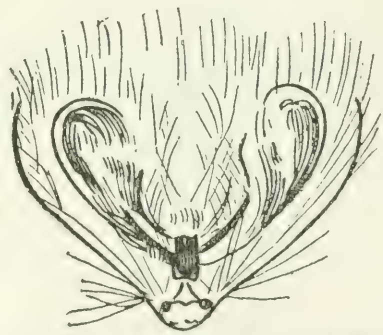

FIG. 66.—Underside of Gopher's head, showing the "pockets."

ADDRESS BY MR. HENRY H. LYMAN, MONTREAL.

GENTLEMEN.—Your President, or should I not rather say our President as I also am enrolled as a member of the North West (Canada) Entomological Society, has asked me to contribute a paper on the best means of furthering the aims of the Society, for the annual meeting.

Living so far east from the headquarters of the Society it is not easy to be fully aware of the conditions under which the work is carried on.

In our Montreal Branch of the Entomological Society of Ontario we have only about 20 members, but as all but one or two live in Montreal or the surrounding municipalities it is easy for us to get together, and we usually hold eight or nine monthly meetings during the winter season.

These meetings are generally held at the house of the President, but sometimes at the houses of other members or in the Natural History Museum. When held in private houses we generally have some refreshments, such as coffee and cake, or lemonade, etc., and social conversation after the adjournment of the meeting.

Probably the holding of such meetings would not be practicable in the case of the North West Society, on account of the members being too much scattered.

For myself, not being an agriculturist, I must confess that my interests lie more on the purely scientific side of the subject, but doubtless you are more interested in the practical side of the matter and desire to know how best to fight the insects which are always attacking your crops.

The first suggestion that I would make is that you should join the Entomological Society of Ontario as a branch, as the benefits to be derived from such union are very great as I think I can show you.

Membership in the Society only involves an annual subscription of one dollar per member, half of which sum is retained by the Branch for its own expenses, while the other half is transmitted to the head office at London, Ont. This, surely, is a very moderate subscription when the benefits received are considered, and I would now invite your consideration to those benefits. In the first place each member of the Branch becomes a full member of the Society with all the rights and privileges. Each member receives regularly the monthly journal of the Society, the Canadian Entomologist, which, though a highly scientific magazine, always contains something of interest even to the tyro. Each member also receives the Annual Report of the Society, and this will probably be the most important consideration to the majority of the members, especially as the value of this privilege has been greatly enhanced of recent years as Prof. James, the Deputy Minister of Agriculture of Ontario, has adopted the practice of sending to all members who are not in arrears a bound volume containing not only the Annual Report of the Entomological Society but also the Annual Report of the Fruit Growers' Association of Ontario and the Annual Report of the Fruit Experiment Stations of Ontario. The volume for 1898 recently distributed contained altogether 403 pages fully illustrated and of great interest and value to agriculturists and fruit growers.

And while the advantages of belonging to the larger society are so great there are no disadvantages. The North West Branch would be still as free as it is now to manage its own affairs, and would have the advantage of all this valuable and popular agricultural and scientific literature, and if this suggestion were adopted the membership of the Branch could be divided into honorary and regular.

As every year Dr. James Fletcher, the Entomologist and Botanist of the Experimental Farms, makes a trip through the Northwest Territories, I would suggest that if possible the Society should receive from him an annual lecture under the auspices of the Society.

One other suggestion that I should make is that those who make collections of insects or plants should be most particular in labeling them with the exact locality where obtained and date of capture or of blooming, as the case may be, and that those who do not regularly collect specimens should at least preserve specimens of those which are found troublesome, in order that they may be correctly determined, and also that they may be able to compare them with other and similar insects, so many species being easily confused with other forms, and that all observations of interest be invariably entered at the time in a note book, it not being safe to trust even to the best memory in such cases.

In regard to Botany I should say that this science is so closely connected with Entomology that every entomologist should be also a botanist, and every botanist might well be an entomologist also. The flowers of the North West are so beautiful that I should think that everyone must be charmed by them.

I had the pleasure of making a trip across the continent in 1890 and was simply delighted by the beauty of the wild flowers of the prairies. Though travelling rapidly, only stopping a day or two at a few of the principal points, I yet succeeded in making a very respectable collection of both the plants and butterflies of the region traversed, jumping off the train to gather plants at almost every stopping place along the line during the day time.

I regret that I am unable to meet with you at this the first annual meeting of the Society, but hope that you will have a very successful meeting, and if any of my suggestions are deemed worthy of adoption I shall be very glad.

With all good wishes I am,

faithfully yours,

Henry H. Lyman.

Henry Herbert Lyman, M. A.

The portrait prefixed to this volume is that of Mr. Henry Herbert Lyman, of Montreal, who has just retired from the Presidency of the Entomological Society of Ontario. He was born at Montreal on the 21st of December, 1854, and was educated at the West End Academy and the High School, winning at the latter the Davidson medal. From school he proceeded to the McGill University and obtained his degree of B. A., with the distinction of being the Logan Medalist in Geology and Natural Sciences, in 1876; in due course he took his M. A. degree in 1880.

The year following his graduation at McGill (1877) he entered the business of Lymans, Clare & Co., wholesale druggists, in Montreal, of which his father was a principal partner; two years later the firm became Lyman, Sons & Co. Mr. H. H. Lyman is now senior partner in the firm and is also president of the Lyman Bros. & Co. (limited) of Toronto. These business houses are known throughout the length and breadth of the Dominion, and have always been distinguished for their upright dealing, energy and enterprise.

At the same time that he began his business career he joined the volunteers in Montreal; starting as an Ensign in the 5th battalion, now the Royal Scots of Canada, he gradually rose to be Major in 1885, with which rank he retired in 1891.

Though deeply engrossed in business and with much of his leisure taken up by his military duties, he yet found time to devote to his instinctive love for Natural History. When less than eight years old he began to take an interest in insects and to observe their ways, and when only twelve he started to form a collection, the precursor of what is now one of the finest collections of Lepidoptera in Canada. His first printed observations on insects appeared in the 6th volume of the *Canadian Entomologist* (1874), and shewed that even in those early days he was engaged in the rearing of butterflies and moths, a work to which he has largely devoted himself ever since. He has now contributed to eighteen out of the thirty-one volumes thus far published, and has also furnished useful and interesting papers to several of the Annual Reports of the Society. The value of his scientific work and attainments has been widely recognized. Since 1891 he has been a member of the Editing Committee of the *Canadian Entomologist*: in 1895 he was elected Vice-President of the Entomological Society of Ontario and continued to hold that position until his election as President in 1897. He held this highest place in the Society for two years to the great satisfaction of the members, and retired at the recent annual meeting. He is also a Vice-President of the Natural History Society of Montreal, in whose winter lectures he takes an active part; an associate member of the Cambridge Entomological Club; a corresponding member of the New York Entomological Society and of the United States National Geographic Society; an honorary member of the North West (Canada) Entomological Society; Fellow of the Royal Colonial Institute, Member of Council of the British Empire League, and Member of both the British and American Associations for the Advancement of Science. He has also been for the last thirteen years President of the Montreal Branch of the Entomological Society of Ontario, and has done more than any other man to keep alive the enthusiasm of the members and encourage all who show any interest in the subject to persevere in the study and experience for themselves the joys of the ardent naturalist. During all these years nearly all the monthly meetings have been held at his house, and the members have greatly enjoyed his generous hospitality.

Mr. Lyman is a notable example of what a busy man can do. Though engrossed all day long with the duties and cares of a very extensive business, which demands, more perhaps than any other, a close attention to innumerable details, he yet finds time, not only for the pleasures of an energetic collector of insects, but also for the performance of much careful and conscientious scientific work. His published papers are valuable contributions to science, being always characterized by thorough accuracy of statement and shewing the results of painstaking and long-continued research.

C. J. S. B.

BOOK NOTICES.

General Index to Miss Ormerod's Reports on Injurious Insects, 1877 to 1898.—By Robert Newstead, F.E.S. London: Simpkin, Marshall & Co. (Price 18 pence).

For twenty-one years Miss Ormerod has been issuing her valuable Reports of Observations on Injurious Insects, and in them has furnished a most useful mine of information regarding all the principal insects that that have been productive of injury in the British Isles during this long series of years. To render this mine readily available at any moment, a very satisfactory index has been prepared by Mr. Newstead. The greater part of it consists of a "General Index," in which reference is given to every insect treated of in the Reports under its scientific name, with reference also to habits, modes and subjects of attack, etc. This is followed by a "Plant Index," with reference to the insects attacking each; a similar "Animal Index," and a third comprising other matters attacked, such as bones and leather, seeds, etc.

We are glad to learn from her preface to the volume that Miss Ormerod is about to begin a second series of Reports in a somewhat different form. C. J. S. B.

Flashlights on Nature.—By Grant Allen; illustrated by Frederick Enock. Toronto: William Briggs, 29 Richmond Street West. (Price 70 cents). pp. 312.

The late Mr Grant Allen's versatility as a writer is well known, but whatever opinion may be formed regarding his novels and tales of fiction, there can be no question that few authors can be compared with him when he devoted himself to natural history subjects. His papers show that he must have been a most minute and painstaking student of the wonders of plant and animal life, while at the same time his literary skill enabled him to describe what he had seen and studied in a most charming manner and without any loss of scientific precision. He had also the able assistance of Mr. Enock, who is a well-known entomologist, and who evidently aided the author not only with his beautiful drawings but with his careful observations as well.

Most, if not all, of the papers in the volume before us have already appeared in the pages of a widely circulated magazine, but they are well worthy of reproduction in this more permanent and convenient form. They treat of insects, birds and plants, under such titles as the Cows that Ants Milk; a Plant that Melts Ice; a Beast of Prey (spider); a Woodland Tragedy (doings of a Butcher-bird); Marriage among the Clovers; the first Paper-maker, etc. The closing paper, a Foreign Invasion of England, gives an admirable description of the life-history of the Hessian-fly. The illustrations, about a hundred and forty in number, are very beautiful, and in clearness and excellence leave nothing to be desired. Anyone with a love of nature cannot fail to be delighted with the book and to derive a knowledge of many things that were secrets to him before. C. J. S. B.

OBITUARY.

On the 16th of October there passed away at Peterborough one of the original members of the Entomological Society of Ontario. The Rev. Vincent Clementi, B.A., died at the age of eighty-seven years. He was a clergyman of the Church of England but had retired from active service some years ago in consequence of failing eye-sight and other infirmities. Born in England, the son of a famous musicial camposer, U. Clementi, Esq., and educated at the University of Cambridge, he came to Canada in 1855 and settled in Peterborough. In 1863 he was appointed rector of Lakefield, where he remained for eleven years; he then became rector of Lindsay, and on his retirement returned to Peterborough to spend the rest of his days. He was an active member of the Masonic Society and rose to be Chaplain of the Grand Lodge of Ontario. In his younger days, and indeed throughout the whole of his life, he was devoted to natural history, horticulture and art, and was especially interested in entomology. He contributed occasionally to the early volumes of *The Canadian Entomologist*, and took a hearty interest in the welfare and success of the Society. His water colour drawings of insects were remarkable for their accuracy and beauty of execution. He was held in the highest respect and regard by all who knew him, and died a devout and upright man. C. J. S. B.

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